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Increasing Access to Anesthesia in Ethiopia: **Task Shifting**

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Increasing access to anesthesia in Ethiopia: task shifting

ACADEMISCH PROEFSCHIFT

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ABBREVIATIONS

B.Sc.	Bachelor of Science
CPD	Continuing Professional Development
EAA	Ethiopian Association of Anesthetists
FMOH	Ethiopian Federal Ministry of Health
GPA	Grade Point Average
HERQA	Ethiopian Higher Education Relevance and Quality Agency
HRH	Human Resources for Health
LMIC	Low-and middle income countries
MD	Medical Degree
M.Sc.	Masters in Science
NGO	Non-governmental NGO
OSCE	Observed Standardized Clinical Examination
PPH	Postpartum Haemorrhage
UK	United Kingdom
USAID	United States Agency for International Aid
WHO	World Health Organization

CHAPTER ONE: INTRODUCTION

I. THESIS CONTEXT:

In June 2012, a new Project was launched in Ethiopia with the aim of strengthening human resources for health (HRH) in the country. The six year (2012 – 2018) Project, funded by the United States Agency for International Development (USAID), was collaboratively implemented by the Ethiopian Federal Ministry of Health (FMOH) and by a partnership of non-governmental organizations (NGOs) and Professional Associations¹ led by Jhpiego, an international NGO headquartered in Baltimore, Maryland.

The Project was designed to:

- Improve human resources for health **management capacity** within the public sector;
- Increase the **quantity** of competent midwives, anesthetists, health extension workers and other essential health care workers;
- Improve the **quality** of pre-service education and in-service training of health care workers; and
- Generate **research** and evidence on critical HRH issues to inform development of policies, strategies and activities to strengthen HRH development, management and regulation.

Data collected during implementation of this Project has been used to develop the manuscripts in this and two other theses, which collectively summarize key findings on HRH research conducted for various cadres of health workers in Ethiopia. This thesis focuses specifically on data for the anesthetist's cadre, who as a result of **task shifting**, now provide the majority of all anesthesia services in the country.

Ethiopian anesthesia providers can be:

- **Anesthesiologists:** These are physicians and are very limited in number – estimates in 2012 were that only 19 were available for a country with a population of over 80 million at the time.⁵⁶
- **Anesthetists:** These are associate clinicians who currently provide the majority of services as a result of task shifting. It was estimated that there were 252 anesthetists in 2012⁵⁷.

¹ Ethiopia Midwives Association, Ethiopian Association of Anesthetists, Management Sciences for Health, Open University, Project Mercy.

In Ethiopia, anesthesia professionals can either be anesthesiologists, who are physicians with 9+ years of training, or anesthetists, who are associate clinicians. Anesthetists can either be:

- High school graduates who complete 4 years of training at a university, leading to a bachelor of science (B.Sc.) in anesthesia;
- Nurses who complete 3 years of training at a university, leading to a B.Sc. in anesthesia
- Nurses who complete 1 or more years of training at a college, leading to a diploma in anesthesia

A Masters in science (M.Sc.) in anesthesia requires an additional 2-year university training program.

A baseline study conducted by the Project in 2012 reported that basic anesthetist training was available at 6 public universities (30%), and 8 public regional health science colleges (36%). A post graduate master's program was available in only one university. There were 69 anesthetists teaching across the 14 programs, most were men. The number of anesthesia graduating students in the previous year (2011) was 101 from universities, and 33 from colleges, with male students (70%) greatly outnumbering females. There were also critical shortages of required reference materials, models, and other teaching/learning materials.

II. PROBLEM STATEMENT:

It is estimated that over 5 billion people lack access to timely, safe and affordable surgical care, with people living in resource-poor settings facing the greatest disparities¹. The global need for surgical interventions is substantial, and is likely to increase as the prevalence of non-communicable diseases increases.

Shrime et al. estimated the burden of surgical disease by asking both surgical and non-surgical providers to estimate what proportion of patients would, in an ideal setting, benefit from a surgeon in their management. They found that surgery is involved, on average, in 28–32% of the global burden of disease². Another study estimated that 11% of the global burden of disease can be treated with surgery. This includes injuries (38%), malignancies (19%), congenital anomalies (9%), complications of pregnancy (6%), cataracts (5%) and perinatal conditions (4%)³.

Rose et al modeled the estimated minimum global need for surgery based on the regional prevalence of each condition. Findings identified variations by region, such as infectious and parasitic diseases and maternal conditions accounting for more than 50% of the need for surgical procedures in sub-saharan Africa, and the same categories accounting for less than 10% of the surgical procedures in Latin American countries⁴.

Lack of access to surgical care is particularly relevant for maternal health outcomes. In high income countries, critical surgeries such as cesarean section, emergency hysterectomy, removal of ectopic pregnancy, tubal ligation, and dilation and curettage are available and accessible and contribute to averting maternal morbidity and mortality⁵. This is in contrast to resource-limited settings where the met need for emergency obstetric care (the proportion of women with obstetric complications who are actually treated) is as low as 12–31%.

A systematic review and meta-analysis found that anesthesia was reported as the main cause of death in 2.8% of all maternal deaths (direct and indirect) globally, with the sub-Saharan African region having the highest risk of deaths from anesthesia in women undergoing surgery. Exposure to general anesthesia, and administration of anesthesia by associate clinicians, especially those with no formal training, were found to be major risk factors for maternal deaths in this review⁶. In South Africa, the Confidential Enquiry into Maternal Deaths reported that between 2011-2013, obstetric hemorrhage was the second biggest cause of maternal mortality (15.8%), and that bleeding at or after cesarean section was responsible for a third of the obstetric hemorrhage deaths. The report also found that lack of appropriately trained doctors was a significant factor in 47% of maternal deaths due to anesthesia⁷.

It is worth noting that while all efforts should be made to ensure access to cesarean section for all women who need them, care should be taken to avoid unnecessary procedures, through use of timely interventions such as the use of partographs for laboring women⁸.

Though surgery has long been a fundamental part of health service delivery, efforts to ensure that there is adequate infrastructure and personnel for surgical services have lagged behind, particularly in low and middle income countries (LMIC's), where priorities such as the HIV epidemic and poor maternal and child health outcomes compete for limited resources, and surgery is sometimes viewed as a luxury.

Lack of adequate infrastructure, human and financial resources constitute the key barriers to providing surgical services⁹. Patient-related barriers to utilization of surgical care include cost, fear of anesthesia, lack of access to services, and lack of hospital privacy and confidentiality^{10,11}.

Anesthesia is inextricably linked with surgical care. Since 16 October 1846, the first successful public demonstration of the inhalation of ether vapor for pain during surgery¹², anesthesiology has grown to become an independent profession, with anesthesia professionals serving as part of an interdisciplinary team that includes surgeons, obstetricians, operating room nurses, surgical technicians and others.

Given the need to prioritize allocation of scarce resources, there has been a general misperception that anesthesia services should only be provided at specialized health facilities. However, providing basic services such as local anesthesia, intravenous ketamine, spinal and general anesthesia for the management of complications of birth, unsafe abortion, injuries (road traffic accidents, domestic violence, burns, falls, rape) and other conditions can contribute to a reduction in mortality and disability¹³.

There is also a global shortage of the anesthesia workforce. A cross sectional survey of national referral hospitals in five East African countries found that the workforce density of physician anesthesiologists ranged from 0.02 per 100,000 population to 0.13 per 100,000 population¹⁴. LMICs, representing 48% of the global population, have 15% of the anesthesiologists¹⁵.

Challenges of expanding access to anesthesia services are multifaceted – a growing burden of disease and conditions that require surgical interventions, critical shortage of health workers trained to provide anesthesia services, and limited infrastructure and financial resources.

Fortunately, there is increasing focus and global support for the inclusion of surgical and anesthesia care in health related agenda's and priorities. The World Bank Disease Control Priorities (DCP³) publication on essential surgery, amongst other things, dispels the myth that surgery is too expensive by showing that many essential surgical services rank among the most cost-effective of all health interventions¹⁶. The World Health Organization (WHO) issued a policy paper in 2015 urging member states to “develop methods and financing systems for making quality, safe, effective and affordable emergency and essential surgical care and anesthesia services accessible to all who need them”¹⁷, and the Lancet Commission on Global Surgery has developed a series of policy briefs and reports documenting evidence and recommending strategies to improve access to surgery.

Countries are also working to address health worker shortages, and many have developed ambitious and well defined human resources for health plans, which are guiding activities related to education, training, recruitment, deployment, motivation and retention for health workers. While this is a long-term goal, in the short term, many have turned to task shifting as a complementary strategy.

Task shifting as defined by WHO involves the rational redistribution of tasks among health workforce teams. Specific tasks are moved, where appropriate, from highly qualified health workers to health workers with shorter training and fewer qualifications in order to make more efficient use of the available human

resources for health. Task shifting allows health services to be extended to all people in a way that is effective and sustainable¹⁸.

There is a robust body of literature on task shifting. A systematic review found that services for a wide range of diseases can be provided through task shifting, without compromising clinical or programmatic quality¹⁹. In Tanzania, associate clinicians have been shown to perform a majority of major surgical procedures with patient outcomes that were similar to physicians²⁰, and similar findings have been reported in a variety of settings²¹. On the other hand, some studies suggest that task shifting can result in unintended consequences such as concerns of diminishing roles and professional identity for physicians, and concerns by associate clinicians and community health workers of rapid expansion of scopes of practice without the required support, career development, recognition and remuneration^{22, 23}.

Evidence on task shifting specifically for anesthesia services is not as well documented yet. One survey found that anesthetic task shifting occurred in the majority (65%, n = 108) of countries surveyed across all World Bank income groups. In high income countries, 90% of associate clinicians were supervised, compared to low income countries, where all associate clinicians provided anesthetic services without supervision²⁴.

A review of the literature in South Asian countries found that all countries have shifted anesthesia services to associate providers, but the process has been hampered by lack of standardized and structured training, and a weak regulatory, policy and human resources management environment²⁵. A Cochrane review found that no definitive statement could be made about whether associate clinician anesthetists can provide equivalent anesthesia services when compared to physician anesthesia providers²⁶.

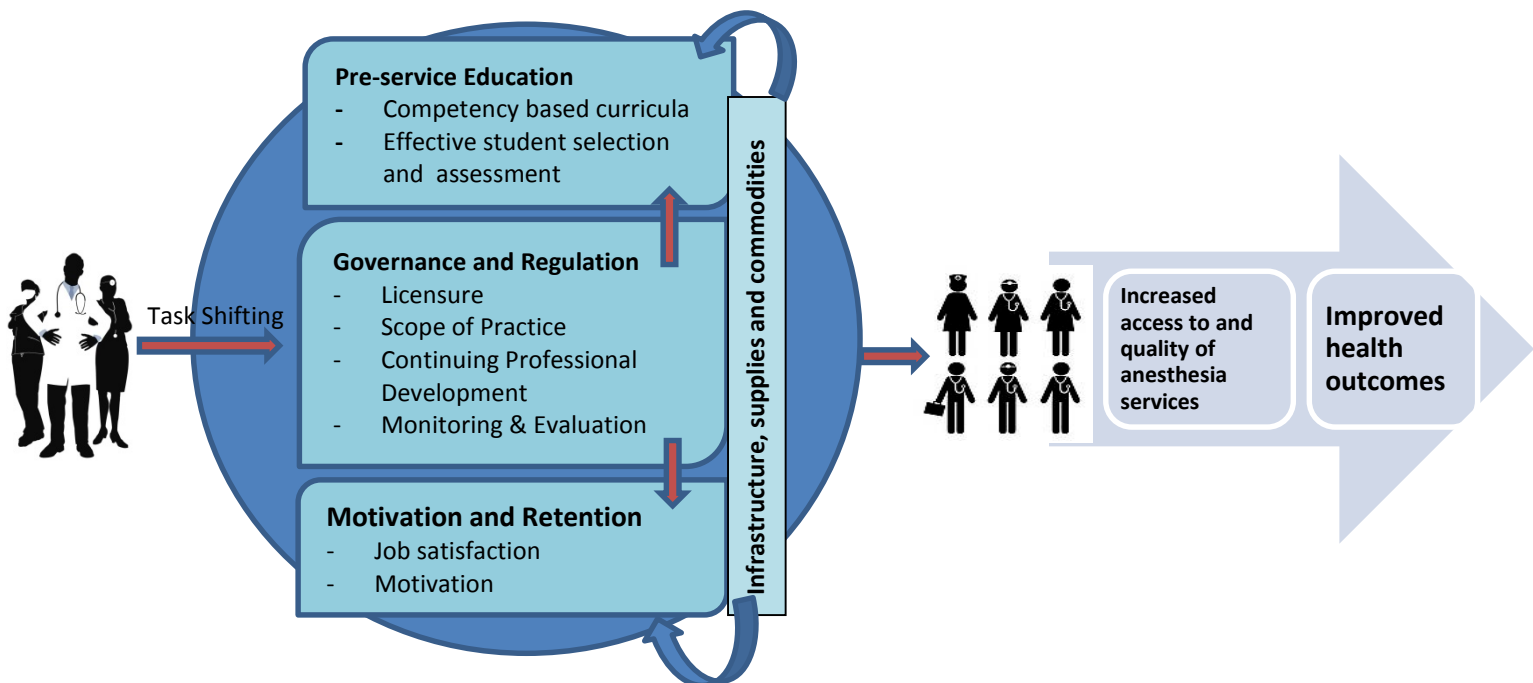
This dissertation contributes to the relatively small body of literature focusing on task shifting of anesthesia services, and examines the issue specifically in Ethiopia, guided by the theoretical framework below.

III. CONCEPTUAL FRAMEWORK & RESEARCH QUESTIONS

The conceptual framework (figure 1) was adapted from the Human Resources for Health Action Framework (<https://www.capacityproject.org/framework/>), which was developed as an initiative of the Global Health Workforce Alliance, with support from the World Health Organization (WHO), USAID, and others.

The Health Action framework outlines a comprehensive approach to addressing countries' HRH challenges, and includes factors that collectively contribute to the development of a strong health workforce, including leadership, policy, finance, partnership, education, etc. For this thesis, factors for which data were available (education, human resources management systems, governance and regulation) were included in the framework, with the assumption that though other elements (financing, partnership, leadership) contribute overall to task shifting, they were not measured here.

Figure 1: Task shifting conceptual framework



Clip art of health workers downloaded from <https://www.gograph.com>

This thesis aims to answer the following main research question – has task shifting from physician anesthesiologists to anesthetists in Ethiopia increased access to safe anesthesia services? The specific research questions to be answered in this thesis are formulated in Table 1. The first and second chapter of the thesis examine the education and training of anesthetists, and document the competency levels of graduating students, as well as the current status of the infrastructure and other learning materials at the training institutions. The third chapter looks closely at the tasks performed routinely by deployed anesthetists, identifying areas where they feel adequately prepared to provide good quality services, and areas that need further strengthening. The final two chapters document the factors associated with motivation and retention for this cadre.

Table 1: Research questions

Research Question	Theoretical Framework	Thesis Chapter	Manuscript research question	Methodology
Are anesthetists in Ethiopia adequately prepared to provide anesthesia services?	Pre-service education	(2) Graduating anesthetists student's competencies	- Are graduating students competent to practice safe anesthesia as defined in the national curriculum and guidelines?	A cross-sectional survey of students from Ethiopian public universities (4) and colleges (6) that graduated students from anesthetist training programs in 2013 was conducted. The study sample included 122 students, who represented 80% of the eligible graduates in that year. Data were collected through direct observations using an Observed Structured Clinical Examination (OSCE), and through a structured interview of the students. In-depth interviews were also used to collect data from 78 faculty, preceptors and skill lab assistants from 9 universities and 17 colleges providing anesthetist or midwifery training programs.
		(3) Trainers perception of learning environment	- What characteristics of students and training institutions are associated with achieving selected competencies in anesthesia?	

Are anesthetists in Ethiopia adequately supported to provide anesthesia services?	Governance and regulation	(4) Anesthetists task analysis	Which tasks performed by anesthetists should be 1) prioritized during pre-service education and in-service training and 2) emphasized during licensure examinations?	A cross-sectional study design was used. A national sample of 137 anesthetists who had been in practice for 6 months to 5 years participated in the study, and completed a questionnaire consisting of 74 tasks that this cadre is expected to perform.
	Motivation and retention	(5) Anesthetists Turn over Intentions	<ul style="list-style-type: none"> - What proportion of anesthetists at public-sector hospitals in Ethiopia intend to leave their jobs in the next one year? - What factors do they consider important when making decisions to remain or leave their jobs? - What factors predict anesthetists' turnover intentions? - Are anesthetists working in public health facilities in Ethiopia satisfied with their jobs? What factors are associated with job satisfaction for this cadre? 	A cross-sectional study design was used to gather nationally representative data from 252 anesthetists from 108 randomly selected hospitals (out of a total of 122), using a structured researcher-designed questionnaire.
		(6) Anesthesia Job Satisfaction		

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Preparing the Health Workforce in Ethiopia: A Cross-sectional Study of Competence of Anesthesia Graduating Students

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ABSTRACT

Background: Efforts to address shortages of health workers in low-resource settings have focused on rapidly increasing the number of higher education programs for health workers. This study examines selected competencies achieved by graduating Bachelor of Science and nurse anesthetist students in Ethiopia, a country facing a critical shortage of anesthesia professionals. **Methods:** The study, conducted in June and July 2013, assessed skills and knowledge of 122 students graduating from anesthetist training programs at six public universities and colleges in Ethiopia; these students comprise 80% of graduates from these institutions in the 2013 academic year. Data was collected from direct observations of student performance, using an objective structured clinical examination approach, and from structured interviews regarding the adequacy of the learning environment. **Results:** Student performance varied, with mean percentage scores highest for spinal anesthesia (80%), neonatal resuscitation (74%), endotracheal intubation (73%), and laryngeal mask airway insertion check (71%). Average scores were lowest for routine anesthesia machine check (37%) and preoperative screening assessment (48%). Male graduates outscored female graduates (63.2% versus 56.9%, $P = 0.014$), and university graduates outscored regional health science college graduates (64.5% versus 55.5%, $P = 0.023$). Multivariate linear regression found that competence was associated with being male and attending a university training program. Less than 10% of the students believed that skills labs had adequate staff and resources, and only 57.4% had performed at least 200 endotracheal intubations at clinical practicum sites, as required by national standards. **Discussion:** Ethiopia has successfully expanded higher education for anesthetists, but a focus on quality of training and assessment of learners is required to ensure that graduates have mastered basic skills and are able to offer safe services.

Keywords: Anesthesia, ethiopia, higher education, objective structured clinical examination, student competency

Background

Despite significant advances in the provision of safe anesthesia in high-income countries,^[1,2] anesthesia-related

and perioperative mortality in low-resource settings remains high,^[3,4] exacerbated by a critical shortage of anesthesia providers.^[5] Estimates suggest that in Ethiopia only 19 anesthesiologists (medical specialists with 9+ years of university training), and 239 anesthetists (a mid-level cadre with 4 years of university training or nurses trained for 1 year) serve a country of approximately 80 million people.^[6,7] Not only is the ratio of anesthesiologists to population in

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Ethiopia among the lowest in the world,^[8] a survey^[9] of nurse anesthetists in Ethiopia found that only 62% could provide safe anesthesia and only 11% could provide obstetric anesthesia (as determined by a tool developed by Hodges *et al.*^[10] to help countries assess the state of anesthetic provision).

Many countries are training mid-level cadres in anesthesia to increase service coverage,^[11-13] but their education and supervision are often under-resourced and their work environments can be challenging.^[14,15] In Ethiopia, rapid expansion of training institutions to meet the great demand for health workers^[7] has put added stress on anesthesia education, with faculty, equipment, and infrastructure in short supply.^[16] This study examines competencies achieved by graduating anesthetist students in Ethiopia. It asks: (1) Are graduating students competent to practice safe anesthesia as defined in the national curriculum and guidelines? (2) What characteristics of students and training institutions are associated with achieving selected competencies in anesthesia? (3) What are students' perceptions of the adequacy of their learning environment?

Methods

Study design and sample

Findings come from baseline data collected as part of a study to evaluate the impact of interventions to improve the quality of education at anesthetist training programs in Ethiopia. All public higher education institutions that graduated students from anesthetist programs in 2013 were eligible for this study. Four universities and six regional health science colleges (RHSCs) met these criteria. (Universities offer a four-year anesthetist training program leading to a bachelor of science degree, while RHSCs offer a one-year diploma program in anesthesia for nurses who have at least two years of work experience). Students at four RHSCs had already graduated when data were collected. Therefore, the study sample is limited to four universities and two RHSCs, representing 6 of Ethiopia's 11 regions. All 153 anesthetist students who graduated from these institutions in 2013 were invited to participate in the study, but 31 had either returned home or did not wish to participate. Thus, the study includes 122 students, representing 80% of graduates.

Measures and instruments

Data come from direct observations of students' knowledge and skills in a simulated setting and structured interviews with students. Competencies to be assessed were selected based on national curricula and guidelines and international nurse anesthetist educational standards,^[17] as well as logistic considerations.

The objective structured clinical examination (OSCE) approach was used because it is a robust method for assessing clinical competence^[18,19] and is used by Ethiopian training

institutions. There were 10 OSCE stations. At six stations, students were observed performing a skill on a mannequin or standardized patient. These stations covered (1) endotracheal intubation; (2) preoperative screening assessment and determination of appropriate anesthesia for the client, including history taking and interpersonal communication; (3) chest examination; (4) neonatal resuscitation; (5) cardiopulmonary resuscitation; and (6) laryngeal mask airway insertion check. At four stations, students were asked to describe or write down the steps they would take to effectively complete a procedure. These stations covered (1) lumbar puncture for spinal anesthesia; (2) the anesthesia work station, including a routine check of an anesthesia machine that students had used during clinical practicums; (3) considerations before and during blood transfusion; and (4) interpretation and management of postoperative complications. For each item on the OSCE checklist, observers responded "yes" (indicating that the item was performed correctly) or "no" (indicating that the item was performed incorrectly or not performed).

Structured interview tools collected student socio-demographic information and posed 12 questions about their experience in the classroom, skills lab, and clinical practicum. Students could respond "yes," "partially," or "no." Students were also asked how many endotracheal intubations they had performed under supervision.

Data collection

Twelve university instructors were recruited to observe and interview the students; all were trained anesthetists with expertise in skills assessments. They attended five days of training, during which they pre-tested the tools and demonstrated their ability to perform OSCE assessments by completing role plays and knowledge tests. To minimize bias, data collectors were assigned to institutions where they were not currently serving as faculty.

Data were collected in June and July 2013, after students had completed their final examinations. The data collection team spent two days, on average, at each training institution. Two co-investigators supervised data collection, verifying that data collectors were recording data appropriately; they did not interfere with the assessment.

Students rotated through each OSCE station, read a case scenario, and then either performed the required skill or described how they would address the scenario. The stations assessed clinical decision-making, communication, and psychomotor skills. The data collector assigned to each station completed a 6- to 16-item checklist while observing each student. Two other data collectors interviewed students after they completed the OSCE. On average, it took 10 minutes for a student to complete each OSCE station and 15 minutes for the interview.

Data analysis

Double data entry and cleaning were conducted using CSPro 5.0. Statistical analysis was performed using STATA version 13.1 software. Assumptions regarding normal distributions and outliers were checked before applying statistical analysis. Composite scores were calculated for each OSCE station; they are the mean percentage of items performed correctly at that station. The overall mean skills score was calculated as the sum of all OSCE station scores divided by the number of stations; hence, each station contributes equally to the overall score. Bivariate and multivariable linear regressions were conducted to identify factors predicting student competence. The dependent variable was the overall mean skills score, and the potential predictor variables in the regression analysis were gender, age, type of training institution, and whether the number of endotracheal intubations performed by each student (self-reported) was at least 200. Student interview responses were divided into two categories (“yes” and “no”) for analysis; responses of “partially adequate/sufficient” were recoded as “no” responses. Since data showed clustering at the level of the schools, bivariate and multivariable regression analyses were performed for independent variables of interest with adjustment for clustering due to study design. Clustering was accounted for by the use of Huber-White (also called Sandwich or robust) standard errors. In the null model, the variations accounted for between institutions was 38.2% (intraclass correlation coefficient = 0.382, with 95% CI = (0.055, 0.709)).

Ethical considerations

The study protocol was approved by the Johns Hopkins School of Public Health Institutional Review Board (IRB #5051). Informed oral consent was obtained from all participants after the aim of the study was explained, and steps were taken to preserve the confidentiality of the information gathered.

Results

Characteristics of study participants

Most study participants were male (72.1%), age 20–24 years (64.7%), and from an urban area (62.3%) [Table 1]. Few had prior job experience related to anesthesia (4.9%), and most attended from university programs (66.4%).

Student competence on selected skills

Higher education institutions in the country use 60% as the cut-off score for competency exams – we considered this as a threshold to judge student competence. The overall mean skills score across all OSCE stations was 61.5% [Figure 1]. Student competence varied across stations, with mean scores highest for spinal anesthesia (79.5%), followed by neonatal resuscitation (74.4%), endotracheal intubation (72.8%), and laryngeal mask airway insertion check (71.1%). Average scores

Table 1: Distribution of study participants by training institution (percentages)

Characteristic	Training institution			P*
	All students (n=122)	University (n=81, 66.4%)	RHSC (n=41, 33.6%)	
Gender				0.584
Male	72.1	69.1	78.1	
Female	27.9	30.9	21.9	
Age in years				<0.001
20-24	64.7	88.9	17.1	
25-30	35.3	11.1	82.9	
Hometown				0.686
Urban	62.3	64.2	58.5	
Rural	37.7	35.8	41.5	
Previous job experience related to anesthesia				0.986
Yes	4.9	4.9	4.9	
No	95.1	95.1	95.1	

*P values are based on Pearson Chi-square tests adjusted for clustering. RHSC=Regional health science college

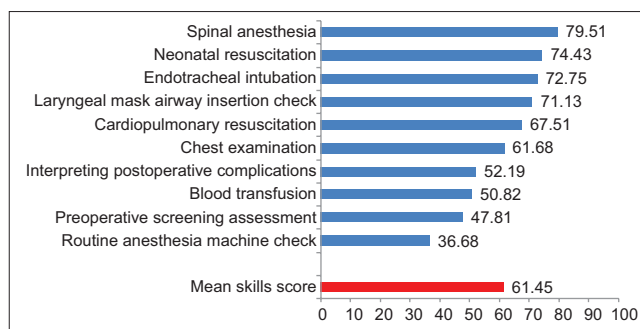


Figure 1: Mean percentage scores of anesthesia graduates, by OSCE station

were lowest for the routine anesthesia machine check (36.7%) and preoperative screening assessment (47.8%).

University graduates significantly outscored RHSC graduates overall (64.5% versus 55.5%, $P = 0.023$) and on two skills: Blood transfusion and laryngeal mask airway insertion check [Table 2]. RHSC graduates did not score significantly higher than university graduates on any skill.

Male graduates significantly outscored female graduates overall (63.2% versus 56.9%, $P = 0.014$) and on two skills: Routine anesthesia machine check and interpretation of postoperative complications. There was no significant difference by gender on the remaining eight skills.

Student perceptions of the learning environment

Less than 10% of students believed that skills labs had adequate staff and resources [Table 3], but approximately half rated their instructors as effective (50.0%) and fair (48.4%). Students rated the clinical practicum highest, but only 55.7% thought they had received sufficient practical experience.

Table 2: Mean percentage scores on objective structured clinical examination stations, by student training institution and gender

OSCE station	Number of items	Training institution			Gender		
		University (n=81)	RHSC (n=41)	P	Male (n=88)	Female (n=34)	P
Spinal anesthesia	10	78.9	80.7	0.589	78.9	81.2	0.609
Neonatal resuscitation	10	75.3	78.7	0.761	75.5	71.8	0.439
Endotracheal intubation	16	71.0	76.2	0.532	74.9	67.3	0.325
Laryngeal mask airway insertion check	9	81.8	50.1	0.040	71.1	71.2	0.984
Cardiopulmonary resuscitation	11	66.3	69.8	0.621	70.6	59.6	0.070
Chest examination	12	65.2	54.7	0.205	65.8	51.0	0.063
Interpretation of postoperative complications	6	55.6	45.5	0.061	54.4	46.6	0.001
Blood transfusion	8	58.8	35.1	<0.001	52.0	47.8	0.395
Preoperative screening assessment	12	50.6	42.3	0.184	48.6	45.8	0.347
Routine anesthesia machine check	12	41.4	27.4	0.185	40.5	26.7	0.027
Mean skills score*		64.5	55.5	0.023	63.2	56.9	0.014

*The mean skills score is the sum of all OSCE stations divided by the number of stations; hence, each station contributes equally to the score. OSCE=Objective structured clinical examination, RHSC=Regional health science college

Table 3: Perceptions of the learning environment, by student training institution and gender (percentages)

Conditions in facilities	All students (n=122)	Training institution			Gender		
		University (n=81)	RHSC (n=41)	P	Male (n=88)	Female (n=34)	P
Classroom instruction and resources							
Classroom resources are available and appropriate	26.2	27.2	24.4	0.851	25.0	29.4	0.712
Instructors are effective in facilitating learning	50.0	42.0	65.9	0.218	43.2	67.7	0.115
Instructors are fair in assessing learning	48.4	34.6	75.6	0.123	45.5	55.9	0.418
Skills lab							
Number of skills lab assistants is adequate	4.9	2.5	9.8	0.248	6.8	0.0	0.375
Skills lab resources are available and appropriate	9.0	8.6	9.8	0.881	10.2	5.9	0.504
Skills lab assistants are effective for learning	9.0	6.2	14.6	0.090	11.4	2.9	0.238
Clinical practicum							
Practicum sites are conducive to learning	38.5	37.0	41.5	0.887	34.1	50.0	0.498
Preceptors are available at practicum sites	72.1	63.0	90.2	0.011	68.2	82.4	0.193
Among students who said that preceptors were available at practicum sites	n=87	n=51	n=36		n=59	n=28	
Preceptors are adequate	35.6	31.4	41.7	0.528	35.6	35.7	0.989
Preceptors' support is adequate at the scheduled time	47.1	38.8	59.5	0.376	44.1	55.6	0.520
Practical experience is sufficient	55.7	58.0	51.2	0.515	53.4	61.8	0.382

RHSC=Regional health science college

RHSC students were significantly more likely than university students to believe that preceptors were available at practicum sites (90.2% versus 63.0%, $P = 0.011$).

Endotracheal intubation

The Ethiopian curriculum requires anesthesia students to perform a minimum of 200 endotracheal intubations at clinical practicum sites. Only 57.4% of graduates reported meeting that standard [Table 4]. University graduates were more likely than RHSC graduates to do so (76.5% versus 19.5%, $P = 0.018$).

Factors associated with student competency

Bivariate and multivariate linear regression models used predictors selected based on trends observed in the preliminary data analysis and discussions among the research team. The

bivariate logistic regression found that the mean skills score was significantly associated with student's gender and type of training institution [Table 5]. These two factors remained significant in a multivariate linear regression: Competence was associated with being male and attending a university training program.

Discussion

Task-shifting of surgical care to mid-level providers may be a safe and sustainable way to address the surgical workforce shortage in low resource settings^[20] and has been used in a number of countries.^[21] Countries have focused on accelerating the production of mid-level cadres, including anesthetists. Training mid-level workers features prominently in national workforce plans in countries such as Zambia, Lesotho,

Table 4: Endotracheal intubations performed by students, by training institution and gender (percentages)

Number of procedures	Training institution				Gender		
	All students	University	RHSC	P	Male	Female	P
	(n=122)	(n=81)	(n=41)		(n=88)	(n=34)	
<200	42.6	23.5	80.5	0.018	44.3	38.2	0.701
200	57.4	76.5	19.5		55.7	61.8	

RHSC=Regional health science college

Table 5: Association between mean skills score and predictors

Predictors (outcome=mean skills scores)	Bivariate linear regressions		Multivariate linear regression	
	Coefficients (95% CI)	P	Coefficients (95% CI)	P
Gender (ref: female)	-	-	-	-
Male	0.063 (0.019-0.107)	0.014	0.076 (0.007-0.145)	0.037
Age in years	0.010 (0.025-0.004)	0.117	0.003 (0.013-0.008)	0.555
Training institution (ref: RHSC)	-	-	-	-
University	0.090 (0.019-0.162)	0.023	0.096 (0.042-0.151)	0.006
Number of ETTIs performed (ref: <200)	-	-	-	-
>200 procedures	0.037 (0.041-0.115)	0.281	0.014 (0.043-0.014)	0.256

RHSC=Regional health science college, CI=Confidence interval, ETTIs=Endotracheal intubations

and Ghana;^[22] in Tanzania^[23] and Mozambique,^[24] mid-level professionals successfully provide major surgery.

The effort to rapidly increase the number of anesthetists in Ethiopia by expanding the number and size of training institutions is a tremendous achievement, but the mean score of 61.5% on the OSCE suggests that some graduates may not be fully prepared to safely provide services upon deployment. This raises questions about the adequacy of the training programs and their learner assessment methods, as study participants had already passed their institutional examinations. Although comparable studies of anesthesia training programs in other countries are not available, research on another mid-level cadre—nurses—suggests that this problem is not limited to Ethiopia. Studies in South Africa and the United Kingdom have identified deficits in the competence of newly qualified nurses.^[25-27]

Student performance was not uniformly low across the skills assessed. The mean score of 79.5% for lumbar puncture for spinal anesthesia is important for Ethiopia, where three-quarters of the population resides in rural areas^[28] with limited access to facilities providing general anesthesia. Similarly, the mean score for neonatal resuscitation (74.4%) suggests that students can effectively address challenges when they encounter birth asphyxia. It is also encouraging that the mean score for endotracheal intubation was 72.8%, even though only 57.4% of students had performed 200 or more endotracheal intubations.

Of concern are low mean scores for routine anesthesia machine check (36.9%) and preoperative screening assessment (44.8%), both of which are essential for patient safety.^[29,30] Training institutions should consider curricula revisions, design of teaching materials, additional credit hours, more practice time in adequately staffed and equipped simulation labs, and increased caseloads and case mix during clinical practice rotations, all of which can strengthen student performance.^[8,31,32]

Verification that students have mastered basic skills before deployment is important, as is ensuring that they receive ongoing support when employed. Strategies include establishment of a national licensing exam,^[33] standardization, validation, and oversight of existing assessments; supportive supervision post-deployment; and in-service training. In Nepal, onsite coaching for anesthesia assistants has proven effective in strengthening their skills.^[34]

Factors affecting student performance

Female graduates consistently performed more poorly on the OSCE than male counterparts. These results differ from previous studies of medical and physiotherapy students in the United Kingdom,^[35,36] medical students in the United States,^[37,38] nursing students in Pakistan,^[39] and anesthesia students in Saudi Arabia,^[40] all of which found that women tend to perform better than men on clinical skills assessments. Our findings call for targeted efforts to support female students during training,^[41] including life skills training, safe campus environments, peer-to-peer coaching, and study support.

University graduates outperformed RHSC graduates on most competencies. Limited clinical practice opportunities and inadequate teaching staff at RHSCs likely play a role, highlighting the need for strengthened infrastructure and qualified instructors at RHSCs. Other options include twinning with nearby universities and RHSCs to mentor faculty and share best practices. RHSCs should also consider ways to increase student exposure to cases, such as weekend and night rotations or collaborating with nearby health facilities. It should be noted, however, that this study did not investigate other potentially important factors, such as program length (one year at RHSCs versus four years at universities) and the nature of the student body (high school graduates seeking a baccalaureate degree versus nurses seeking specialty training).

Student perceptions of adequacy of learning environment

Student perceptions of their learning environment are associated with learning outcomes and attitudes toward studying^[42] and can help identify areas needing improvement.^[43] It is clear that substantial investment is needed in skills labs, clinical practice sites, and the teaching skills of faculty and preceptors.

Strengths and limitations

This study provides insights into the quality of anesthesia higher education in a low-resource setting. The OSCE approach is a reasonably reliable, valid, objective, and practical method of assessing different competency domains (knowledge, skills, and attitudes) during a single assessment.^[19,44-46] However, it is possible that there was an examination bias; we did not examine the gender breakdown of the examiners relative to the scores given to women. In addition, the structured interview tools were not pilot-tested and validated, although inconsistencies and errors were identified and corrected during data collectors' training. We were unable to include all eligible training institutions and students in the study, which may limit our ability to generalize the findings to the national level. However, the four RHSCs excluded from the study because of earlier than expected graduations are not materially different from the two RHSCs included in the sample. It is impossible to know whether the competency of the 31 students who did not participate differed from those observed.

Conclusions

Findings suggest that rapid expansion of higher education programs has not solved the problem of providing safe anesthesia services in Ethiopia, because of limited teaching and learning infrastructure and minimal opportunities for clinical practice. Literature on the link between rapid expansion of higher education institutions and competency of students is not available. However, this study suggests that the emphasis on increasing the number of anesthetists may come at the expense of their competency.

These findings have important implications for policymakers not just in Ethiopia, but across all countries that are struggling to rapidly expand their health workforce. As countries design and implement approaches to scale up higher education, they should prioritize measures that ensure graduates master required skills and can offer safe services. This requires a focus on the quality of training and assessment of learners.

Graduates entering the workforce should also be provided with targeted on-the-job mentoring, supportive supervision, and in-service training to improve and maintain their competence. Further research can help identify factors that are associated with the performance of anesthesia graduates in real world clinical settings, rather than a simulated test environment, and test interventions targeted to underperforming students and institutions.

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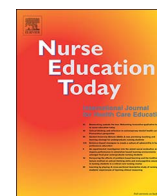
Conflicts of interest

There are no conflicts of interest.

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Trainers' perception of the learning environment and student competency: A qualitative investigation of midwifery and anesthesia training programs in Ethiopia

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A B S T R A C T

Background: Ethiopia has successfully expanded training for midwives and anesthetists in public institutions. This study explored the perceptions of trainers (instructors, clinical lab assistants and preceptors) towards the adequacy of students' learning experience and implications for achieving mastery of core competencies.

Methods: In-depth interviews with 96 trainers at 9 public universities and 17 regional health science colleges across Ethiopia were conducted to elicit their opinions about available resources, program curriculum suitability, and competence of graduating students. Using Dedoose, data were thematically analyzed using grounded theory.

Results: Perceptions of anesthesia and midwifery programs were similar. Common challenges included unpreparedness and poor motivation of students, shortages of skills lab space and equipment, difficulties ensuring students' exposure to sufficient and varied enough cases to develop competence, and lack of coordination between academic training institutions and clinical attachment sites. Additional logistical barriers included lack of student transport to clinical sites. Informants recommended improved recruitment strategies, curriculum adjustments, increased time in skills labs, and better communication across academic and clinical sites.

Conclusions: An adequate learning environment ensures that graduating midwives and anesthetists are competent to provide quality services. Minimizing the human resource, infrastructural and logistical gaps identified in this study requires continued, targeted investment in health systems strengthening.

1. Background

Ethiopia has reduced under-five mortality by two-thirds, trained and deployed a large cadre of Health Extension Workers, and increased the number of health care facilities nationwide (Ayalew et al., 2012; Bilal et al., 2011).

However, the country continues to grapple with a high maternal mortality ratio of 676 maternal deaths per 100,000 live births (Central Statistical Agency, 2012), low utilization of health facilities (approximately 85% of births take place at home) (Central Statistical Agency, 2014), a high rate of fistula incidence (3500 per year) (Dubay and Box,

2013), a high rate of childhood stunting (44% of under-fives), and a high unmet need for family planning (Central Statistical Agency, 2012).

These challenges are exacerbated by a critical shortage of health workers, including midwives and anesthetists. Though the number of midwives increased from 1275 in 2008 to 4725 in 2012 (UNFPA and Ethiopian Midwives Association, 2012), this is still below the 8760 required to ensure that 95% of births are attended by skilled providers (UNFPA et al., 2014). Similarly, estimates suggest that only 19 physician anesthesiologists (Chao et al., 2012) and 252 mid-level anesthetists (Ayalew et al., 2012) serve this population of approximately 95.9 million (Haub and Kaneda, 2014).

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The government has aggressively expanded the number of public institutions training healthcare professionals and implemented approaches that minimize the duration of training. An accelerated midwifery training program provides diploma-level nurses with an additional year of training, upon which they graduate as midwives. Similarly, diploma-level nurses graduate as Level V anesthetists after a one-year program at regional health science colleges (RHSCs) or as bachelor's-level anesthetists after a 2.5-year university program.

Classroom and clinical learning environments—including quality of teaching, supervision, and facilities—are significantly associated with achievement in medical education (O'Sullivan, 2015). Studies of medical school graduates have found that the learning environment is a significant predictor of preparedness for practice (Dijkstra et al., 2015; Tokuda et al., 2010). Multiple survey instruments have been developed and validated to quantitatively assess students' perceptions of diverse health sciences learning environments (Bigdeli et al., 2015; Brown et al., 2011; Papathanasiou et al., 2014; Tackett et al., 2015; Tokuda et al., 2010). In contrast, studies on trainers' perceptions of the health education learning environment are rare. (Downey and Asselin, 2015; Lockwood et al., 2009). Though trainers' expert opinions offer an important vantage point from which to evaluate the learning environment, qualitative accounts of trainers in low-resource settings are largely absent from the literature.

This qualitative study examines the perceptions of classroom instructors and skills lab assistants who work at training institutions and preceptors who supervise students at clinical practice sites. The study sought to answer the following research questions:

1. How do trainers at midwifery and anesthesia programs perceive the learning environment for facilitating mastery of selected core competencies?
2. How do trainers perceive the competence of anesthesia and midwifery students at graduation?
3. What changes do trainers recommend to improve the competency of students who graduate from midwifery and anesthesia programs?

2. Methods

2.1. Study Design

The study was a baseline of a pre-post evaluation study to determine whether interventions under the USAID-funded Strengthening Human Resources for Health (HRH) Project improved the competence of midwifery and anesthesia graduates. A qualitative analysis, using grounded theory, was conducted using in-depth interviews with instructors and skills lab assistants at public midwifery and anesthesia training programs and preceptors at clinical practice sites.

2.2. Sampling

A total of 31 universities and 25 RHSCs in the public sector were providing health science training when these data were collected. This study was limited to institutions that graduated students from midwifery and/or anesthesia training programs in 2013; Exclusion criteria included inaccessibility, inadequate information on graduation status, or unavailability of students. The study sample was therefore limited to 26 institutions: 9 universities and 17 RHSCs.

The 26 institutions sampled were drawn from six of Ethiopia's nine regions (Amhara, Benshangul Gumuz, Harari, Oromia, Tigray, and Southern Nations, Nationalities and Peoples) and one of the country's two city administrations (Addis Ababa).

We conducted in-depth interviews with one instructor, one skills lab assistant, and one preceptor at each of 32 programs (78 informants associated with midwifery programs and 18 with anesthesia programs) (Table 1).

2.3. Data Collection

Separate interview guides for instructors, skills lab assistants and preceptors were developed by HRH Project staff. In-depth interviews were conducted in December 2013 over a three-week period, and scheduled based on informant availability. Data collectors probed for information and opinions regarding the curriculum, assessment methods, clinical competence of graduating students, staffing and equipment, and challenges to teaching and learning. Interviews were conducted in Amharic and ranged in length from 40 to 75 min (average: 50 min). Each interview was tape-recorded, and data collectors took notes.

2.4. Data Management and Analysis

Recorded interviews were transcribed and translated into English by a private research company. Recordings of transcripts from three institutions (one anesthesia university program, one HSC with both anesthesia and midwifery, and one HSC midwifery program; 9 total transcripts) were inaudible, resulting in a smaller sample size (29 programs at 24 institutions; 87 interviews) than originally planned. Interview transcripts were analyzed using an inductive grounded theory approach and Dedoose qualitative data analysis software (www.dedoose.com). A co-author developed an annotated codebook of 22 nested codes based on emergent themes related to the research questions. As data was coded, iterative memo-writing and dialogue with other co-authors helped to refine the code structure, collapsing and expanding codes and sub-codes to refine and describe emerging themes. The coding process resulted in more than 2800 code applications. Coded excerpts for each theme were circulated to the other co-authors to ensure passages were coded appropriately, and checked for completeness of coding using text search spot-checks and graphical code application matrices in Dedoose.

2.5. Confidentiality and Ethical Considerations

Field notes and transcripts were kept on secured computers. Although institution names were preserved to assist in the detection of patterns, no personal identifiers of informants were retained in the transcribed text. Once uploaded to Dedoose, data were secured with an encryption key known only to the primary coder.

The study protocol was approved by the Johns Hopkins School of Public Health (JHSPH) Institutional Review Board prior to data collection. Data collectors explained the purpose of the study to all study participants, who were assured that their information would be kept confidential, and obtained oral informed consent from all informants to audiotape their interviews.

3. Results

There were few differences between informants' assessments of anesthetist and midwifery programs and also between universities and RHSCs. We present results for these programs and training institutions together, but note where informants' appraisals differ. Five themes emerged that informants associated with the quality of training and competency of institutions' graduates (Table 2):

3.1. Assessing Student Competency

Institutions use different methods to assess student competency. Three midwifery programs reported having no internal skill assessments, instead relying on feedback from clinical sites (e.g., logbook entries and checklists) to assess students. More established programs tended to report having well-developed and continuous internal assessment methods, often using Objective Structured Clinical Examination (OSCE) to ensure competency prior to sending students

Table 1
Number of instructors, skills lab assistants, and preceptors interviewed.

Type of institution	Midwifery			Anesthesia		
	Instructors	Skills lab assistants	Preceptors	Instructors	Skills lab assistants	Preceptors
University	9	9	9	4	4	4
RHSC	17	17	17	3	3	3
Total	26	26	26	6	6	6

Table 2
Emergent themes.

- Difficulties assessing competency
- Student numbers and caliber
- Curriculum suitability and sequence
- Lack of infrastructure and equipment
- Lack of coordination between academic and clinical sites

to clinical rotations.

Five of the 29 instructors critiqued external assessments, such as the Centre of Competence (COC) exam, asserting that internal assessments were a more reliable measure of students' knowledge and skills:

I have heard that one of our top students failed the [COC] exam because he was told that he didn't inject Vitamin E. This is such a minor thing. You should be able to see the competency of that person; that is, if he misses this, would we lose the mother or the baby? If he misses a core thing, he should fail—that might possibly teach him something. – Midwifery preceptor

Informants' perceptions of graduating students' competency were based largely on observations. Midwifery informants generally agreed that students could effectively manage short-acting contraceptives (16 informants), antenatal care (24 informants), uncomplicated delivery (30 informants) and immediate newborn care (14 informants), but not labor complications (16 informants), instrumental delivery (14 informants), long-acting contraceptives (7 informants), or manual vacuum aspiration/post-abortion care (17 informants). The six anesthesia informants who commented specifically on skill mastery remarked that while intubation/airway management/resuscitation and general anesthesia skills were generally considered good, especially in universities, students lacked competency in spinal/regional anesthesia, often attributed to lack of equipment and supplies in skills labs.

3.1.1. Caliber and Number of Students

Many informants (56 of 87, 64%) were critical of the quality and motivation of students, particularly midwifery informants (52 of 72, 72%).

Most of the time, students joining the midwifery program are those who have poor academic performance. We don't know why they are assigned there...Health science [entering students] join public health, anesthesia, psychiatry and other programs. The remaining students, who are poor students, will join the midwifery program; since the background of these students is not good, it is difficult to make them academically excellent. – Midwifery instructor

Eleven informants suggested basic education reforms, screening procedures, and government-mandated admissions criteria to raise the caliber of entering students. Others recommended allowing students to choose their own field of study, rather than assigning them to programs that do not interest them, though one remarked that recent awareness-building efforts to stimulate interest in midwifery had helped recruit more motivated students.

Informants also complained that the large numbers of students overwhelmed available facilities and staff, particularly in skills labs and clinical rotations:

[You] are supposed to attend at least 200 cases before graduation; previously it was possible to get this number of cases since the total number of students was around 12, so they can work at operation rooms every day, but the number of students is currently 30 or more. Additionally, there are post-basic and MSC students; therefore, getting adequate number of cases will be difficult. – Anesthesia instructor

3.1.2. Curriculum Suitability and Sequence

Instructors (13 of 29, 45%) commonly referred to the teaching-learning approach as “student-centered” and/or “participatory,” although traditional lecture methods were the predominant mode of delivery for theory courses. Several instructors specified that the ideal time ratio of theoretical to practical learning was 70%:30%, but most felt that there was insufficient time for practical skill building, particularly in midwifery programs and at universities.

Reviews of the midwifery and anesthesia curricula content were largely positive, although seven anesthesia informants complained that spinal/regional anesthesia was not covered in the curriculum. Midwifery informants thought the curriculum was lacking in training on long-term contraceptives, Expanded Programme on Immunization, and partograph use. Midwifery informants were also concerned that core coursework was delayed until the third and fourth year of training, too late to build competence during clinical rotations.

Numerous instructors (12 of 29, 41%) voiced skepticism about the new modular curriculum gradually being adopted nationwide, saying it lacks clear guidelines, overlooks important skills, requires additional time (e.g., summer sessions/extra weeks), and is not supported with appropriate materials:

The negative thing is, the modules we have lack guidelines. The teachers have problems due to this. They usually download it from the internet. There are times where they don't get everything. That is our challenge. When the curriculum comes it should come with modules and manuals. – Midwifery instructor

A few informants (2 preceptors and 2 instructors) considered the curriculum adoption process neither consultative nor culturally sensitive:

The major problem is curriculum design because it does not include the important context of our country. Most of the time, we are not involved or requested to give our opinions to improve the curriculum contents. We usually have problems translating this curriculum into practice and teaching it. – Anesthesia preceptor

3.1.3. Lack of Infrastructure and Equipment

With few exceptions, deficiencies in infrastructure and equipment were universal. Eighty-three percent of training programs (24 of 29 programs) said they had insufficient numbers of simulation mannequins in skills labs. Several of the newer and smaller academic institutions (5 of 24 institutions) either lacked a skills lab or had just one lab for the use of multiple training programs:

Normally, students should practice in a skills lab before they perform intubation on a real patient. But here they are directly exposed to real patients under our strict supervision... We don't have a skills lab, but a

lot of things could be changed if we had one. – Anesthesia skills lab assistant

At clinical practice sites, there were reports of lack of supplies resulting in altered standard of care and missed opportunities to develop student competence:

We teach the science on regional, spinal and auxiliary anesthesia. There are also cases, but when we enter to perform on the cases, materials are not available. So, we opt to perform general anesthesia. – Anesthesia preceptor

3.1.4. Lack of Coordination between Academic and Clinical Sites

A major concern voiced by many preceptors (26 of 29 preceptors, 90%), was the challenge of matching students with clinical rotation sites that ensure hands-on exposure to an adequate number and diversity of cases:

Students are well exposed to postnatal care, postnatal physical examination and newborn assessment as there are enough cases. Newborn resuscitation, immediate newborn care, labor and delivery are so scarce that a student may graduate even without touching one. – Midwifery instructor

Students may not perform the minimum required number of deliveries (for midwifery) or intubations (for anesthetists). Informants worried that limited clinical experience impacts student competence, particularly in more complicated cases.

Absence of case variety limits students from gaining skills. They perform only routine cases. – Anesthesia instructor

Half of the programs (14 of 29 programs, 48%) reported transportation challenges (cost and logistics) in assigning students to institutions where there are adequate cases. Preceptors also felt hampered by insufficient coordination with instructors and administration: they complained that they were not introduced to students or informed of their training needs, were not given guidelines to evaluate students, and rarely had clear information about who was responsible for paying for or providing equipment and supplies that students used.

4. Discussion

This study highlights how deficiencies in the learning environment limit students' development of core competencies in both midwifery and anesthesia programs in Ethiopia. In a recent evaluation, graduating midwifery students in Ethiopia scored just 52%, on average, on an OSCE exam (Yigzaw et al., 2015), while graduating anesthesia students scored an average of 61% (Kibwana et al., 2016). Our informants' concerns and suggestions point to opportunities to improve the learning experience and, ultimately, the competency of midwifery and anesthesia students.

4.1. Student Selection

Expanding the ranks of essential health cadres in low and middle income countries requires an adequately prepared and motivated pool of potential candidates (Feldacker et al., 2014). Studies show that targeted recruitment positively affects student selection and retention (Currie et al., 2007; Kaye et al., 2010). Yet students in Ethiopia do not choose particular health professions; rather, they are assigned based on qualifying scores on eligibility examinations (Fullerton et al., 2011). In Ethiopia, lower-scoring students are typically assigned to midwifery studies (Adegoke et al., 2013), an additional challenge for achieving competency during training (Fullerton and Leshabari, 2010). Our informants' complaints about students who lack motivation and basic literacy suggested that the aggressive scale-up of training programs may have outstripped the availability of informed, prepared potential

students.

Formal admission criteria, including literacy minimums, entrance examinations, and/or an in-person interview or written statement of interest in the program could facilitate the selection of applicants with greater potential to achieve clinical competency.

4.2. Curriculum and Assessments

Health training curricula must strike a balance between theory, demonstration, and clinical experience (Fullerton et al., 2011; Mumbo and Kinaro, 2015), but few training institutions in low-resource settings engage in regular curriculum development and review. In Ethiopia, adoption of a standardized modular curriculum has allowed for condensed training of multiple levels and specialties of students at the same time, while minimizing training duration; accelerated training programs have increased midwives by at least one-third (Ayalew et al., 2012; UNFPA and Ethiopian Midwives Association, 2012).

Ideally, curricula should balance national priorities with international competencies (Mumbo and Kinaro, 2015), and adaptation of curricula should be informed by a detailed assessment of institutions' strengths and weaknesses (Freistadt et al., 2014). Curriculum reviews should also ensure that the sequence of coursework and rotations builds clinical skills in a logical order (Bluestone et al., 2013). Core midwifery- and anesthesiology-specific courses should ideally be offered earlier than the final year of a four-year degree program.

Assessment is a cornerstone of competency-based approaches to health professional education (Frenk et al., 2010); Coordinated efforts to develop and disseminate standardized tools and training materials could help programs develop appropriate assessment instruments (Mumbo and Kinaro, 2015).

4.3. Infrastructure, Equipment and Clinical Skills Labs

Shortages of essential equipment, supplies, and human resources in health training institutions pose a problem across LMICs (Cherian et al., 2010; Rason et al., 2010), and our findings show that Ethiopia is no exception. Our informants vividly described how rapid growth in the number of students has exacerbated these problems, particularly with regard to the time and space available for practice in skills labs.

Adequate skills lab experience prior to clinical rotations builds student confidence and capacity to handle difficult cases, allows an opportunity for quantitative assessment using OSCEs, and relieves pressure on clinical preceptors (Johnson et al., 2013; Matveevskii and Gravenstein, 2008; Walsh et al., 2009). Simulation training has been associated with marked improvements in knowledge, skills, and clinical performance of health workers, as well as moderate improvement in patient-related outcomes (Cook et al., 2011; Cooper et al., 2012; Frenk et al., 2010).

Multiple complaints by our study informants about deficient infrastructure, equipment and skills labs highlight a priority area for improvement. Access to existing skills labs could be expanded either by hiring more skills lab assistants or appointing student volunteers to provide supervision during evenings or weekends.

4.4. Linkages between Academic and Clinical Sites

Coordination between academic and clinical training sites is essential to student supervision, mentoring, case exposure, and competency, but it has been largely overlooked in the literature (Pitts et al., 1990; Snyder et al., 2010). The training programs that our informants viewed most favorably, and which they associated with producing the most competent graduates, were those that maintained close coordination with clinical practicum sites.

Our informants confirmed earlier findings that limited resources for transportation to clinical sites poses an important barrier (Ayalew et al., 2012), but they also highlighted how safety concerns may restrict the

hours during which students—especially females—can attend cases. Creating a practicum transport fund, providing nighttime local transport, and/or building dormitories on hospital grounds or nearby can help overcome these barriers. Supporting night shift service improves case flow and reduces overcrowding, which offers the added benefit of ameliorating patient privacy concerns; however, this will also require additional preceptors (Fullerton and Leshabari, 2010).

Matching students to clinical rotation sites in appropriate numbers, at appropriate times, and with knowledgeable preceptors requires careful coordination (Freistadt et al., 2014; Fullerton and Leshabari, 2010). Stakeholders might consider the feasibility of developing systems to place students at rotation sites to reduce inter-institutional overlap and ensure adequate case flow.

4.5. Study Strengths and Limitations

This is one of the first studies to investigate perceptions of the learning environment among trainers of medical cadres in low-resource settings. The study was conducted nationally, only excluding institutions that were not graduating students at the time of the study. However, potential limitations may limit the transferability of the study findings. Interview discussion guides were only minimally pretested during data collectors' training, but interviewers had been well trained, so the transcripts bore no indication that informants failed to comprehend the questions. The smaller number of anesthesia training programs in Ethiopia (compared to midwifery programs) led to fewer interviews from this area; this imbalance is reflected in the relative dearth of quotes from anesthesia programs. Technical problems with the recordings from three institutions led to a smaller sample size than planned. While some variability was lost due to this mishap, we were still able to detect common themes across the data as well as a wide range of opinions.

5. Conclusions

Rapid increases in the number and size of training programs for health professionals in LMICs demand intensive material and human resource inputs. Our study found widespread deficits in the learning environment of midwifery and anesthesia training programs in Ethiopia. Opinions of the curriculum, skills labs, and clinical practicum were predominantly critical, citing crowded programs with unmotivated students, under-equipped skills labs, and poorly coordinated clinical sites that do not promote adequate case exposure and opportunities to develop clinical competencies. Informants' assessments of the learning environment suggest that these deficits threaten students' mastery of core competencies. Midwifery and anesthesia informants had largely similar concerns.

Investment in human resource capacity-building for health in Ethiopia and other low-resource countries is a step in the right direction to strengthen health systems. However, there is a need for targeted investments – for example, in infrastructure and supplies at under-equipped training institutions and in new teaching materials suited to the local context—but also for new models and approaches to recruit qualified students, assure sufficient clinical experience for students, and promote communication between academic and practical sites.

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ORIGINAL ARTICLE

Education, Practice, and Competency Gaps of Anesthetists in Ethiopia: Task Analysis

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Purpose: This study assessed the needs and gaps in the education, practice and competencies of anesthetists in Ethiopia.

Design: A cross-sectional study design was used.

Methods: A questionnaire consisting of 74 tasks was completed by 137 anesthetists who had been practicing for 6 months to 5 years.

Findings: Over half of the respondents rated 72.9% of the tasks as being highly critical to patient outcomes, and reported that they performed 70.2% of all tasks at a high frequency. More than a quarter of respondents reported that they performed 15 of the tasks at a low frequency. Nine of the tasks rated as being highly critical were not learned during pre-service education by more than one-quarter of study participants, and over 10% of respondents reported that they were unable to perform five of the highly critical tasks.

Conclusions: Anesthetists rated themselves as being adequately prepared to perform a majority of the tasks in their scope of practice.

Keywords: anesthesia, nursing, task analysis, Ethiopia.

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GLOBAL PERIOPERATIVE MORTALITY has declined by almost 90% in the past 50 years, with the greatest decline in developed countries.¹ However, many people in low-resource settings do not have access to safe and affordable surgical care, in part because of a shortage of health workers to provide these services.²

Ethiopia requires a sizable and competent health workforce providing surgical care, given its population of approximately 96 million,³ and an estimated average of 43 operations per 100,000 conducted within a district hospital catchment population.⁴ A caesarian section rate of 1.5% suggests a huge unmet need,⁵ and a high rate of road traffic injuries,⁶ also

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point to the necessity for surgical services. Anesthesia professionals in Ethiopia can either be anesthesiologists, who are medical specialists with 9+ years of university training, or anesthetists, a cadre with 4 years of university training or 1 year of additional training for nurses. This study focuses on the anesthetist cadre only.

The Ethiopian government has made significant efforts in the last decade to address the shortage of anesthesia professionals by expanding education and training opportunities for anesthetists. The number of public tertiary institutions providing anesthesia education increased from three universities in 2005 to 26 institutions in 2016, including 12 universities and 14 Regional Health Science Colleges (RHSCs).

RHSCs offer a 1-year program leading to a diploma in anesthesia, and universities provide a 4-year Bachelor of Science degree (BSc) in anesthesia. Additional education leading to a master's degree in anesthesia is available and adds to the scope of work for the anesthetists. Information regarding the level of competence that graduating anesthetists bring to their work place is limited. A recent study⁷ indicated that some graduating anesthesia students were unable to successfully perform key skills during an observed structured clinical examination.

Data-driven decision making regarding improvements in the pre-service education and in-service training for this cadre is critical in this context. Educators, human resource managers, policy makers, and other stakeholders require evidence to guide decisions regarding curricula revisions, continuing professional development, and on-the-job supervision and coaching.

The Strengthening Human Resources for Health (HRH) Project (2012 to 2017), funded by the United States Agency for International Development, is implementing various interventions at all levels in the health system in Ethiopia. Project objectives include increasing the availability of qualified anesthetists, and building local capacity for continuing professional development, licensure, deployment, regulation, and retention of this cadre. The HRH Project conducted a task analysis study to generate relevant information about the anesthetist cadre.

Task analysis is a descriptive study methodology that can be used to explore the practice of a health profession. Originally used in industry to improve work efficiency, it is used to identify gaps in education, regulation, and practice of health workers, and to provide information for updating curricula, scope of practice documents, and development of licensing examinations.^{8,9} Task analysis data are collected from currently practicing workers, which provides a level of detail not available from curricula, job descriptions, or scope of practice documents. There is limited literature on the use of this methodology for this cadre of anesthesia providers; the authors found only one published study¹⁰ that reported using task analysis to inform government modifications to the education, training, and practice of anesthetic tasks by medical licentiates in Zambia.

The aim of this task analysis study was to provide information to assess needs and gaps in the education, practice, and competencies of anesthetists in the country. The objectives of the study were to identify tasks performed by anesthetists that should be (1) prioritized during pre-service education and in-service training and (2) emphasized during licensure examinations.

Methods

A cross-sectional study design was used. A draft list of expected tasks performed by anesthetists was developed from existing national anesthesia training curricula, job descriptions, national occupational standards for anesthesia, and the scope of practice for anesthetists. A panel of subject matter experts comprising of university and college anesthesia faculty, currently practicing senior anesthetists, and representatives from the Ethiopian Federal Ministry of Health and the Ethiopian Association of Anesthetists reviewed the draft task list. Based on their knowledge of the local context either as educators or practitioners, the experts reviewed the items for inclusion and finalized a list of 74 items of anesthesia-related skills, which comprised the task list for the study tool. The tool also included questions related to basic socio-demographic variables. The tool was translated from English to four local languages (Amharic, Oromifa, Tigrigna, and Somali languages) by a translating firm.

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The study was conducted in six of the 11 regions in the country (Tigray, Amhara, Oromia, Southern Nations, Nationalities and Peoples, Harari, and Addis Ababa City Council). At the time of the study, an estimated 252 anesthetists were providing health care services in the country. More than 92% of them ($n = 240$) were working in these six regions.¹¹ The five regions not included (Gambela, Beninshangul-Gumuz, Somali, Dire Dawa, and Afar) were omitted as a very limited number of anesthetists—only 12—were working in these regions.

Recently graduated anesthetists, who had been in practice for 6 months to 5 years and currently working in health facilities managed by the government, were eligible for inclusion in the study sample. Anesthetists not currently in practice or working in privately managed health facilities were excluded from the study. Anesthesiologists were not included in the study.

We intended to recruit a purposive sample of 20 anesthetists from each region. Regional Health Bureaus sent letters to district health offices in their region, asking them to select anesthetists who met the criteria. However, with the exception of Addis Ababa and Oromia regions, the other regions had less than 20 anesthetists who met the criteria. We therefore requested the Oromia and Addis Ababa regions to recruit additional anesthetists.

From the 240 anesthetists working in the six regions, 140 anesthetists who met the criteria were purposively selected and invited to participate in the study. Efforts were made to survey a range of anesthetists in terms of work experience, educational training institute, and geographic distribution. Of the 140 invited, 137 consented to participate in the study.

Twelve data collectors were recruited, two from each region. Data collectors were trained anesthetists with previous experience in service provision. Supervisors, who included representatives from the Federal Ministry of Health and HRH Project staff, were paired with the data collectors (one supervisor per region), and both the data collectors and supervisors attended a 5-day study orientation and training session that included pretesting of the tools, ethics review, and informed consent.

Data were collected between December 9 and 13, 2013. A data collection workshop was conducted in each target region. Participants completed individual study tools to provide responses for each task in four key measurement areas of frequency, criticality, ability to perform the task, and where the task was initially learned (Table 1). For questions related to where a task was learned, the participant was asked where s/he had first learned the task—and in instances where a provider had been taught a skill both in pre-service and during in-service, only the first instance of learning (in this case pre-service), was documented. Each tool, which included 74 tasks, took approximately 3 hours to complete.

Data were entered into Microsoft Excel (Microsoft Corporation, Redmond, WA) and exported to SPSS 20 (IBM, Armonk, NY)¹² for further analysis. Data were then cleaned by running frequencies and checking for outliers. Descriptive analysis (frequency and cross tabulation) was performed based on the four measurement variables (frequency, criticality, performance, and location of training). For our analysis purposes, we created the frequency categories of “low” frequency, defined as responses of rarely or never; “moderate” frequency, defined as responses of monthly; and “high” frequency, defined as those responses of either daily or weekly.

Reviewing task categories in combination is more informative than simply reviewing the number and percentage of participants who selected a certain measurement variable for each task. To identify tasks which require additional emphasis during pre-service education and in-service training for this cadre, the authors first selected tasks that were rated as being highly critical (>50% of the respondents rated the tasks as being highly critical, thus important for patient outcomes). The criticality ratings were then cross tabulated with responses related to (1) frequency of performance, (2) location of training, and (3) perceived inability to perform the tasks.

Frequency tasks were selected if more than 50% of respondents reported that they performed them at either a high frequency (daily or weekly), or tasks which more than 25% of respondents reported that they performed at a low frequency (never or rarely).

Table 1. Key Measurement Areas

Variable	Response Options	Operational Definitions
Frequency—how often is the task performed?	<ul style="list-style-type: none"> • Daily • Weekly • Monthly • Rarely • Never 	High frequency tasks High frequency tasks Low frequency tasks Low frequency tasks
Criticality—how critical is the task in terms of patient outcomes?	<ul style="list-style-type: none"> • High • Moderate • Low 	High criticality tasks High criticality tasks
Performance—how competent is the respondent in the performance of the task?	<ul style="list-style-type: none"> • Proficient • Competent • Not capable 	Unable to perform
Location trained—where was training received?	<ul style="list-style-type: none"> • Pre-service • In-service • On-the-job • Never trained 	Not taught in pre-service Not taught in pre-service Not taught in pre-service

Location tasks were selected if more than 25% of respondents reported that they were either “never trained” “trained during in-service” or were “trained on the job” to perform. We also selected all tasks on which more than 10% of respondents reported that they were “not capable” of performing.

Cut-off values were determined subjectively by the research team. For highly critical and high frequency tasks, we selected tasks which the majority of the respondents (>50%) reported as meeting the relevant response options. To determine cut-off values for tasks related to location of training or perceived inability to perform tasks, the authors reviewed the frequency tables, considering tasks that were directly related to patient outcomes, and considering current local anesthesia education and practices.

Ethical Considerations

The study protocol received ethical approval from the Johns Hopkins School of Public Health (JHSPH) Institutional Review Board, Baltimore, Maryland. Oral informed consent was obtained from the study participants before administering the study tool. At the workshops, to ensure anonymity, data were collected individually and responses were not shared or discussed among participants.

Findings

Demographic Characteristics

Most respondents were men (74%), and had a Bachelor of Science degree (60%). Respondents ranged in age from 22 to 55 years, with the majority being above the age of 24 years (80.3%). The duration of professional work experience ranged from 6 months to 4.9 years, with a mean of 2.17 years. The largest number of respondents was from the Addis Ababa City Council (34.3%), as is expected given the larger concentration of professionals in urban areas, with the lowest from Harari region (6%) (Table 2).

Description of Tasks and Criticality

The 74 tasks included a wide range of activities performed by anesthetists, summarized in the following broad technical categories:

1. Preparation and optimization of patients for surgery and patient safety, eight tasks.
2. Care of anesthetic machines, monitoring related equipment and drugs, seven tasks.
3. Postanesthesia care, three tasks.
4. Emergency and critical care, nine tasks.
5. Interprofessional collaboration and communication, professionalism, management and leadership, and scholarship, 25 tasks.

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Table 2. Demographic Characteristics of Respondents

Characteristic	All Respondents (n = 137)	%
Gender		
Male	101	74
Female	36	26
Education level		
Diploma	55	40
Bachelor of Science	82	60
Age, y		
< 24	27	20
> 24	110	80
Region		
Tigray	19	14
Amhara	20	15
Oromia	29	21
SNNP	14	10
Harari	8	6
Addis Ababa	47	34

SNNP, Southern Nationals, Nationalities, and Peoples.

6. Specialty-specific domains (obstetrics, neurosurgery, pediatric, geriatric, neonatal, cardiothoracic, ophthalmic, and ear, nose, and throat, intraoperative patient management), 22 tasks.

Fifty-four of these tasks (72.9%) were rated by over half of respondents as being highly critical to patient outcomes.

Most of the tasks rated as not highly critical were related to professional, rather than clinical duties (such as “serve on professional related committees,” and “maintain membership in a professional organization”). Similarly, over half of respondents reported that 52 tasks (70.2%) were performed at a high frequency (on a weekly or daily basis). For the 20 tasks that were not rated as being highly critical, there was a wide variation in what providers thought were highly critical versus moderately or low criticality tasks. As an example, for the task “supervise staff, students, or ancillary personnel,” 36.5% of respondents reported that the task was highly critical, 43.1% thought it was moderately critical, and 20.4% thought it was of low criticality.

Highly Critical Tasks Not Taught in Pre-service

Fifteen of the tasks rated as being highly critical, were not learned during pre-service education by more than one-quarter of study participants

(Table 3). On the job training was the most common pathway to acquire this skill, with fewer percentages reporting that they never learned the tasks at all or learned them during in-service training.

Highly Critical Tasks Rated as Being Unable to Perform

More than 10% of participants reported that they were unable to perform five of 54 highly critical tasks (Table 4). Four of these tasks were also reported to be performed at a low frequency (Table 5).

Highly Critical Tasks and Frequency of Performance

More than 50% of participants reported that almost all (45/54; 83%) highly critical tasks were performed at a high frequency (weekly or daily). On the other hand, participants rated 15 tasks as being highly critical, but reported that they performed them at a low frequency (never or rarely; Table 5).

The task “implement necessary procedures to overcome major obstacles and enable safe access and egress at the scene of an incident” met analytical criteria for inclusion in each of these analyses, indicating that although a majority felt that it was a critical task, it was performed at a low frequency; participants reported that they were not taught the task during pre-service, and reported that they were unable to perform it.

Discussion

Given the critical shortage of anesthetists, the vast size of the country, and limited road transportation, access to health facilities that can provide surgery is difficult for a large part of the Ethiopian population.¹³ The study aimed to identify priority areas for revision or updates within the Ethiopian public education and training system for anesthetists, who when adequately trained and equitably deployed, can expand access to anesthesia services. The use of task analysis for similar purposes has been reported elsewhere.^{8,14,15} Although data related to the frequency, criticality, performance, and location of training were collected, this article focuses on findings that were most relevant to identifying gaps in pre-service education, and priorities for licensure examinations.

Table 3. Percent of Anesthetists Who Reported That They Did Not Receive Pre-Service Education for Tasks Rated as Highly Critical (N = 137)

Task Definition	Rated the Task as Highly Critical	% of Providers Who			
		Reported the Task as Not Taught in Pre-Service*			
		OJT	NT	IST	Total
Implement necessary procedures to overcome major obstacles and enable safe access and egress at the scene of an incident	75.2	17.5	10.2	5.8	33.5
Apply infection control to all activities within the pre/post and intraoperative environment	74.5	16.1	2.2	15.3	33.6
Monitor cleaning, high level disinfection, and sterilizing of equipment before use	70.8	13.9	2.2	15.3	31.4
Function within legal and ethical framework with responsibility and accountability for her/his own practice	70.1	17.5	2.2	14.6	34.3
Provide regular drills on intubations, cardiopulmonary resuscitation, and other emergency management for all interfacing cadres	67.2	16.8	9.5	10.2	36.5
Uphold infection prevention standards	65	19.1	8.8	24.1	52.0
Monitor professional work standards	63.5	19.1	8.8	11.7	39.6
Promote a safe working environment	62.8	26.3	3.6	21.9	51.8
Request consultations	62.8	16.8	5.1	8.8	30.7
Plan and maintain adequate stocks of anesthetic drugs and supplies	61.3	29.2	5.8	10.2	45.2
Manage communication related to adverse events	55.5	15.3	4.4	9.5	29.2
Provide clinical/administrative oversight of anesthesia-related care in other departments: respiratory therapy, PACU, operating room, SICU, pain clinics, etc.	52.6	35.0	4.4	12.4	51.8
Maintain professional conduct in interactions with co-workers, patients, and their families	51.8	26.3	2.9	14.6	43.8
Evaluate the effectiveness of client's safety strategies	50.4	14.6	7.3	13.1	35.0
Implement and monitor compliance with legal and ethical requirements relevant to the operating room environment	50.4	24.1	2.2	5.8	32.1

IST, trained during in-service; NT, never trained; OJT, trained on-the-job; PACU, postanesthesia care unit; SICU, surgical intensive care unit.

*Reported that they were either OJT, or NT.

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Table 4. Percent of Anesthetists Who Reported That They Were Unable to Perform Tasks Rated as Highly Critical (N = 137)

Task Definition	% of Providers Who	
	Rated the Task as Highly Critical	Reported That They Were Unable to Perform the Task
Perform preanesthetic assessment and evaluation to determine fitness for anesthesia and optimize patient condition	83.9	18.2
Implement necessary procedures to overcome major obstacles and enable safe access and egress at the scene of an incident	75.2	16.8
Participate in the management of critically ill patients in the ICU	70.1	11.7
Provide regular drills on intubations, cardiopulmonary resuscitation, and other emergency management for all interfacing cadres	67.2	10.2
Provide clinical/administrative oversight of anesthesia-related care in other departments: respiratory therapy, PACU, operating room, SICU, pain clinics, etc.	52.6	10.9

ICU, intensive care unit; PACU, postanesthesia care unit; SICU, surgical intensive care unit.

Provider Perceptions Versus Standards

The 54 tasks rated by providers as being very important for patient outcomes reflect their perception of the current reality of practice. Any differences when compared with expectations outlined in the local scope of practice and occupational standards could inform further discussions and review by key stakeholders, including the Federal Ministry of Health and training institutions, and could guide revisions to the existing scope of work as appropriate.

For the 20 tasks not rated as being highly critical, the wide variation in what respondents reported to be either highly critical versus moderately or low criticality tasks could be a reflection of the variation in the current practices—many of these tasks were related to professional and management tasks, which many anesthetists may not get an opportunity to perform.

The following tasks were not selected as being highly critical by most of the respondents—use of appropriate invasive monitoring modalities (45.3%), perform peripheral nerve blocks and local

infiltrations (31.4%), and participate in the management of long-term pain (43.8%). However, based on expert knowledge of the anesthesia training in Ethiopia, and on the expectations for anesthesia service provision in the country, authors who were local experts felt these three tasks should have been rated as highly critical, and may have been underestimated or misunderstood by respondents.

One task (use of appropriate invasive monitoring modalities), was also reported by 58.4% of participants as being one that they were unable to perform. This task was removed from the diploma and BSc level anesthetist scope of practice by the Federal Ministry of Health after this study was conducted. It is now conducted by the Masters level and physician level anesthesia providers only.

Strengthening Pre-Service Education and In-Service Training

Ideally, all highly critical tasks should be covered in pre-service education, ensuring that graduates can proficiently perform the services on deployment. Content taught during pre-service should also be carefully mapped to the tasks that providers

Table 5. Percent of Anesthetists Who Reported That They Rarely or Never Performed Tasks Rated as Highly Critical

Task Definition	% of 137 Providers Who	
	Rated the Task as Highly Critical	Reported Performing the Task at a Low Frequency
Provide effective basic life support	88.3	36.5
Participate in management of a patient with shock	84.7	27.0
Provide neonatal resuscitation services	83.9	30.7
Perform advanced cardiac life support effectively	83.2	61.3
Manage anesthesia/surgical-related complications	83.2	25.5
Implement necessary procedures to overcome major obstacles and enable safe access and egress at the scene of an incident	75.2	42.3
Participate in management of a patient with trauma	75.2	35.8
Provide postoperative patient care in the recovery room/PACU	70.8	29.1
Participate in the management of critically ill patients in the ICU	70.1	63.5
Provide regular drills on intubations, cardiopulmonary resuscitation, and other emergency management for all interfacing cadres	67.2	51.8
Request consultations	62.8	38.6
Provide postanesthesia follow-up evaluation and care	60.6	28.5
Provide clinical/administrative oversight of anesthesia-related care in other departments: respiratory therapy, PACU, operating room, SICU, pain clinics, etc.	52.6	43.8
Implement client counseling and stress management plan	52.6	27.7
Conduct anesthesia for day surgery	51.8	42.3

ICU, intensive care unit; PACU, postanesthesia care unit; SICU, surgical intensive care unit.

actually perform on deployment, based on government packages of health services.¹⁶ It is encouraging that out of 54 tasks identified as highly critical, respondents only selected five tasks that they felt they were unable to perform, one of which has since been removed from the scope of practice. This suggests that overall, anesthetists feel confident in their ability to adequately perform the majority of important tasks required of them. Although their perception of performance may not necessarily correspond to their actual performance, which can only be measured through observation, it can be assumed to be a proxy of performance. These four tasks should be prioritized for appropriate interventions such as revisions in the curricula, and an increased allocation of required skill-based practice. Beyond pre-service, these tasks should also be considered during in-service training for this cadre.

Participants reported that they were first taught how to perform 15 highly critical tasks either on the job, during in-service training or were not taught how to perform them at all. These tasks

are all included in the nationally approved pre-service curriculum, indicating that there could be gaps within the training institutions in ensuring that they are covered appropriately during pre-service. Most of these tasks are related to “non-technical” skills, which can contribute to safe and efficient task performance.¹⁷ These skills should be emphasized during pre-service education, and further reinforced during in-service training for this cadre to ensure that already deployed anesthetists are provided with the required knowledge and skills in these areas. Addressing the tasks during continuing professional development,^{18,19} supportive supervision and ongoing coaching and mentorship is also recommended. Regular simulation practice^{20,21} and job-site drills can also play key roles in ensuring that learned skills are maintained.

It is worth noting that after this study was conducted, the government held a meeting to revise the occupational standards for diploma level anesthetists, and the task “Implement necessary procedures to overcome major obstacles and

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enable safe access and egress at the scene of an incident” was omitted from the standards given the lack of clarity on the expectations for performance. This could explain why respondents reported that it was performed at a low frequency, that they were not taught the task during pre-service, and reported that they were unable to perform it.

Licensure Examinations

At the time of the study, the government of Ethiopia was initiating the process of introducing and implementing licensure examinations for graduating health professionals, including anesthetists. Task analysis data can be used to develop licensure examinations that have relevant and validated content. The 45 tasks rated by anesthetists participating in this study as being of high frequency and high criticality ($n = 45$) should be included in licensure examinations as they indicate standard responsibilities required of each practitioner. They should also be prioritized for ongoing supportive supervision and coaching to ensure that the skills are maintained.

The 15 tasks identified as being both highly critical, and also as being rarely or never provided on deployment are also important for inclusion in the licensure examinations. These tasks highlight activities that providers may not always have an opportunity to perform, yet, they are required to be competent in providing these services if needed, given their criticality.

Although this study did not inquire about reasons why these tasks were not performed, potential explanations could include low caseloads, lack of provider confidence or lack of adequate supplies and equipment,²² and could vary from facility to facility. Postoperative care and pain management often are not a priority in teaching or practice in resource poor settings because of limited or absent postoperative care facilities and a very limited portfolio of analgesic drugs.²³

We recommend additional investigation to determine factors that could be affecting the provision of tasks that were rarely performed. These tasks could also be prioritized during in-service training, as providers need to be able to maintain their knowl-

edge and skills, even with limited opportunities for practice.²⁴ Other potential solutions include routine practice on simulation models, or short-term annual practice in other institutions with high case-loads.

Limitations

Although five of the 11 regions in the country were not represented, approximately 54% of the total estimated number of anesthetists in the country were sampled. The unrepresented regions are classified as “emerging” regions, which are traditionally rural, remote, and underserved. At the time of the study, there were 12 anesthetists working in these regions. It is possible that anesthetists working in these emerging regions may have different experiences in their reality of practice. A large proportion of anesthetists are currently practicing in urban areas, such as Addis Ababa, the capital city, thus there were greater numbers sampled from these areas.

Conclusions

Given the critical shortage of anesthetists in the country, it is important to prioritize investments in the education and training for this cadre. Investments need to be targeted and result in graduates acquiring the competency to provide relevant services to the community. The findings from this task analysis identify gaps in education and performance, and help to identify areas that stakeholders can begin to address to strengthen pre-service education, in-service training, and the development of licensure examinations for this cadre.

It may be necessary to consider additional and periodic in-service training for specific tasks that are highly critical, but which are either rarely performed or for which inadequate training is provided at the pre-service level. This can be combined with on-site drills or simulation on models to build provider skills, while minimizing their time away from the health facilities.

Findings from the study can also be used to review and refine the national scope of practice document and job descriptions for anesthetists. The authors recommend that a similar exercise be conducted periodically⁸ to provide the evidence that the education and training provided for this cadre

continues to match the realities of practice and needs of the clients at the service delivery level.

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Factors Predicting Ethiopian Anesthetists' Intention to Leave their Job

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Abstract

Background

Ethiopia has rapidly expanded training programs for non-physician anesthetists in order to address shortages of anesthesia providers. However, retaining them in the public health sector has proven challenging. This study aimed to determine anesthetists' intentions to leave their jobs and identify factors that predict turnover intentions.

Methods

A nationally representative, cross-sectional survey of 251 anesthetists working in public-sector hospitals in Ethiopia was conducted in 2014. Respondents were asked whether they planned to leave the job in the next year and what factors they considered important when making decisions to quit. Bivariate and multivariable logistic regressions were conducted to investigate 16 potential predictors of turnover intentions, including personal and facility characteristics as well as decision-making factors.

Results

Almost half ($n=120$; 47.8%) of anesthetists planned to leave their jobs in the next year, and turnover intentions peaked among those with 2 to 5 years of experience. Turnover intentions were not associated with the compulsory service obligation. Anesthetists rated salary and opportunities for professional development as the most important factors in decisions to quit. Five predictors of turnover intentions were significant in the multivariable model: younger age, working at district rather than regional or referral hospitals, and the perceived importance of living conditions, opportunities for professional development, and conditions at the workplace to decisions to quit.

Conclusions

Human resources strategies focused on improving living conditions for anesthetists and expanding professional development opportunities may increase retention. Special attention should be focused on younger anesthetists and those posted at district hospitals.

Introduction

A shortage of anesthesia providers contributes to a crisis in access to surgical services in low- and middle-income countries (LMICs). The *Lancet* Commission on Global Surgery has estimated that 94% of the population in LMICs lacks access to safe, affordable anesthesia and surgical care [1]. Surgically treatable conditions, including in the field of obstetrics, however, make up an increasing proportion of the burden of disease in these settings [2]. To increase availability of anesthesia services, LMICs have shifted tasks from anesthesiologists to non-physician cadres, such as nurses and anesthetists [3], and these providers now deliver most anesthesia services worldwide [4, 5]. But high turnover – driven by poor working conditions, limited remuneration, and low morale among other factors – has undermined efforts to expand the number of anesthesia providers in some LMICs [1, 6, 7].

Designing strategies to reduce turnover among anesthesia providers requires a good understanding of the local context because education, supervision, support, and working conditions vary widely [1, 4, 6–10]. Information about this essential cadre, however, remains limited [5]. This paper examines the situation in Ethiopia, where a shortage of anesthesia providers limits surgical and obstetric services [11]. Although estimates vary, there are certainly very few practicing physician anesthesiologists in Ethiopia, and most hospitals rely exclusively on associate clinician anesthetists [11]. The Federal Ministry of Health (FMOH) has set explicit goals to increase the number of anesthetists by more than fivefold by 2025 [12]. To accomplish this, the FMOH expanded the number of pre-service education programs for anesthetists from two in 2006 to 26 in 2015 and introduced accelerated anesthetist training options for experienced nurses [13]. It has also implemented multiple interventions to strengthen the quality of anesthetist education.

Retaining newly trained anesthetists in the public sector has proven challenging [14, 15] despite a compulsory service obligation requiring anesthetists who graduate from public training institutions to serve one to four years at a public hospital, depending on the length of training, region, and sponsoring organization. This paper analyzes data on

Ethiopian anesthetists' turnover intentions, that is, whether they intend to leave their current job in the next year. This is widely accepted as the best available predictor of actual turnover [16]. We explore three questions: What proportion of anesthetists at public-sector hospitals in Ethiopia intend to leave their jobs in the next one year? What factors do they consider important when making decisions to remain or leave their jobs? What factors predict anesthetists' intentions to leave their job?

Material and Methods

Study design and sample

The Strengthening Human Resources for Health (HRH) Project (2012-2017) conducted a nationwide survey of job satisfaction, motivation, and turnover intentions among Ethiopian health workers at public-sector hospitals in 2014. A cross-sectional study design was used to gather nationally representative information on anesthetists at a randomly selected sample of 108 hospitals (out of the 122 total). Data collectors invited all eligible anesthetists at these hospitals to participate in the study. Anesthetists were eligible if they were full-time permanent hospital employees, had at least six months of work experience in anesthesia, and were available and willing to participate. Their training varied. Diploma Level 5 anesthetists are experienced nurses who have completed a 1-year Regional Health Science College training program. In the past, Advanced Diplomas were awarded to nurses with two years of anesthesia training, but this training track was discontinued. To receive a BSc in anesthesia, high school graduates must complete a 4-year university program, while experienced nurses must complete a 3-year university program. An MSc requires an additional 2-year university training program.

An adjusted minimum sample size of 232 anesthetists was calculated using statistical parameters of 95% confidence interval, expected proportion of intention to leave as 0.5, a design effect of 1.2, and a relative precision of 10%. On average, 2.4 anesthetists (range: 1 to 10) were interviewed at each of 104 hospitals in 10 of Ethiopia's 11

administrative regions and cities, for a total sample of 251 anesthetists; no anesthetists were available for interview at four hospitals.

Data collection

Data were collected from May 28 to June 14, 2014. Individual interviews were conducted in private in the national language, Amharic. Interviewers read a series of closed-ended questions aloud to each respondent from a structured questionnaire and recorded their answers. The questionnaire was adapted from a job satisfaction and motivation tool developed by the Capacity Project for use with health workers in Uganda [17]. No systematic studies exist on the reliability and validity of the tool. However, health workers' understanding of the questions was checked during a pre-test of the tool in the Oromia region, after which the wording and sequence of certain questions were revised to ensure their clarity and relevance to the Ethiopian setting.

Interviewers asked respondents about their demographic characteristics and work history, intentions to leave the job, and perceptions of conditions at home and at work that might affect retention. To assess turnover intentions, interviewers asked a yes-or-no question: "Are you planning to leave your job in the next one year?" To assess perceptions of 20 items that studies suggest may affect health workers' decisions to leave their jobs, interviewers asked: "If you were planning to leave your job, how important would each of the following items be in that decision?" Respondents rated each item on a Likert scale, from 1 (not important) to 5 (extremely important).

All 24 interviewers had university degrees in health or social science, and one supervisor was assigned to each region. Supervisors were drawn from HRH Project staff. Data collectors and supervisors attended two days of training, which included role plays and practice interviews and covered consent procedures, research ethics, and interview techniques.

Data analysis

Data were entered into Epi-Info and exported to STATA 13.1 for cleaning and analysis. Exploratory factor analysis and a literature review [18] were used to group 20 decision-making items into six uncorrelated factors: living conditions, conditions at the workplace, relationship with supervisor and co-workers, work burden, opportunities for professional development, and basic salary. To check reliability and internal consistency of items in each factor, we calculated Cronbach's alpha coefficient [19]. Values exceeded the 0.7 cut-off for all factors except conditions at the workplace ($\alpha=0.619$). Chi-square was used to test for associations between turnover intentions and demographic and work-related characteristics, with a p-value <0.05 used to determine statistical significance.

Bivariate analysis assessed the independent effect of each predictor on turnover intentions. Then a multivariable logistic regression model was fitted, using a stepwise (backward) variable selection process to extract potential predictors of turnover intentions. After entering all variables into the model, stepwise selection was used to remove those where $p>0.3$, leaving six variables. Multicollinearity among predictors was assessed to ensure reliability of the multivariable model. Adjusted odds ratios and 95% confidence intervals were calculated to show the magnitude of associations.

Ethical considerations

The John Hopkins University Institutional Review Board approved the study protocol, and the Ethiopian FMOH gave permission to conduct the study. Before each interview, data collectors read a consent script in Amharic to obtain informed verbal consent. To ensure confidentiality, individual identifiers were not used during data collection and analysis.

Results

Respondents' characteristics and turnover intentions

Most respondents had a bachelor's degree ($n=145$; 57.8%) (Table 1). They had served in the public health system from 6 months to 37 years (median=4.8 years); for some,

this included prior service as nurses. Almost two-thirds (n=162; 64.5%) were currently fulfilling a compulsory service obligation, with 2 to 72 months remaining (data not shown).

Almost half (n=120; 47.8%) planned to leave the job in the next year, but turnover intentions were significantly lower among those over age 30 (n=36; 37.1%) and those with dependents (n=83; 43.5%) (Table 1). Turnover intentions exceeded 60% among anesthetists with 2 to 5 years of service and those working at district hospitals. Fulfillment of the compulsory service obligation did not predict intention to leave.

Table 1: Distribution of respondents and percent who intend to leave their jobs in the next year, by socio-demographic and work-related characteristics

Characteristic	All respondents		Respondents who intend to leave their jobs in the next year		
	Number	Percent distribution (n=251)	Number	% of total	p-value*
Total	251	100	120	47.8	na
Gender					
Male	188	74.9	95	50.5	0.136
Female	63	25.1	25	39.7	
Age					
≤30 years	153	61.2	83	54.2	0.008
Over 30 years	97	38.8	36	37.1	
Marital Status					
Single	135	53.8	70	51.8	0.055
Ever married	116	46.2	50	45.0	

Dependents

Yes	191	76.1	83	43.5	0.014
No	60	23.9	37	61.7	

Educational qualification

Master's degree	18	7.2	5	27.8	0.104
Bachelor's degree	145	57.8	71	49.0	
Advanced diploma	36	14.3	14	38.9	
Diploma Level 5	52	20.7	30	57.7	

Years of service in public**health system**

6 months – 2 years	83	33.1	41	49.4	0.010
>2 years – 5 years	53	21.1	34	64.2	
>5 years	115	45.8	45	39.1	

Currently fulfilling**compulsory service****obligation ^a**

Yes	162	64.5	78	48.1	0.575
No	89	35.5	42	47.2	

Type of facility

District hospital	65	25.9	40	61.5	0.033
Regional/Zonal hospital	94	37.4	42	44.7	
Referral hospital	92	36.6	38	41.3	

^a The government requires anesthetists who graduate from a public educational institution to work (compulsory service) for 1-4 years in the public sector.

*Chi-square test

Factors affecting decisions to leave the job

Among the six decision-making factors, respondents rated basic salary (mean score=4.52; SD=1.0) and professional development opportunities (mean score=4.22; SD=0.89) as most important and living conditions as least important (mean score=3.42, SD=0.89). Conditions at the workplace (mean score=3.72; SD=0.94), work burden (mean score=3.54; SD=1.2), and relationship with supervisor and co-workers (mean score=3.51; SD=0.98) were of intermediate importance. Table 2 shows how respondents rated individual items. Over 85% said low pay, limited opportunities for promotion, poor access to higher education, safety concerns, and high cost of living were important.

Table 2: Percentage of anesthetists who consider items important in decisions to leave the job, mean and median scores

Items	N	% who say factor is important ^a	Score	
			Mean	Median
Living conditions				
High cost of living	251	87.2	4.07	5
Lack of housing facilities	246	82.9	3.82	4
Poor/lack of utilities (water, electricity) at home	249	78.7	3.49	4
Poor educational facilities for children ^b	163	77.9	3.58	4
Transportation problems	243	70.0	3.23	3
Work is far from home	218	58.3	2.93	3
Lack of access to telephones to stay in touch with family and friends	244	52.9	2.77	3

Conditions at the workplace

Concerns about safety at work ^c	251	89.2	4.08	4
Poor access to supplies and equipment at work	251	79.7	3.63	4
Poor/lack of utilities (water, electricity, Internet) at work	251	74.9	3.45	4

Relationship with supervisor and co-workers

Lack of recognition for good work	249	83.6	3.78	4
Unfair treatment by a supervisor	249	77.6	3.70	4
Poor supervision and feedback	249	74.3	3.29	3
Social conflicts in the workplace	249	73.9	3.28	4

Work burden

Heavy workload	249	79.5	3.55	4
Long hours of work	251	78.5	3.54	4

Opportunities for professional development

Poor access to higher education	250	93.6	4.44	5
Limited opportunities for promotion	250	92.4	4.32	5
Limited opportunities for in-service training	251	83.7	3.88	4

Basic salary

Low pay	250	93.6	4.52	5
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Note: Response scale was: not important (1), somewhat important (2), important (3), very important (4), and extremely important (5).

^a Includes responses of: extremely important, very important, and important

^b Question was only asked of respondents with children.

^c Safety concerns focused on aging and unreliable anesthesia machines, exposure to infection due to lack of supplies, and physical trauma from moving heavy gas cylinders

The bivariate analysis found that turnover intentions were associated with two decision-making factors (living conditions and professional development opportunities) plus age, dependents, years of service, and facility type (Table 3). The final multivariable model included six variables, five of which were significant predictors of turnover intentions. Intention to leave the job fell by 5% with each additional year in age (adjusted OR=0.95, 95% CI=0.92, 0.99). Anesthetists at referral hospitals were half as likely to intend to leave the job as those at district hospitals (adjusted OR=0.48, 95% CI=0.23, 0.98). The more importance anesthetists attached to living conditions, the more likely they were to intend to quit (adjusted OR=1.83, 95% CI=1.17, 2.86); the same was true for opportunities for professional development (adjusted OR=1.91, 95% CI=1.26, 2.90). This pattern was reversed for conditions at the workplace: anesthetists who considered this factor more important were *less* likely to intend to leave the job (adjusted OR=0.63, 95% CI=0.4, 0.99).

Table 3: Bivariate and multivariable logistic regressions: intention to leave the job in the next year (outcome), by socio-demographic characteristics and importance of decision-making factors

Predictors	Bivariate logistic regression		Multivariable logistic regression ^a	
	Crude OR	95% CI	Adjusted OR	95% CI
Gender				
Male (ref.)	-			
Female	0.644	0.36-1.15		
Age in years	0.952	0.92-0.98	0.952	0.92-0.99
Marital status				
Single (ref.)				
Ever married	0.703	0.43-1.16		
Dependents				
No (ref.)				
Yes	0.478	0.26-0.87		
Educational qualification				
Master's degree (ref.)				
Bachelor's degree	2.494	0.85-7.36		
Diploma (Advanced or Level 5)	2.600	0.85-7.91		
Years of public health service				
	0.960	0.93-0.99		

Currently fulfilling compulsory service obligation				
No (ref.)				
Yes	1.039	0.62-1.74		
Type of facility				
District hospital (ref.)				
Regional/zonal hospital	0.505	0.27-0.96	0.525	0.26-1.05
Referral hospital	0.440	0.23-0.84	0.476	0.23-0.98
Importance of decision-making factors				
Living conditions	1.534	1.14-2.06	1.830	1.17-2.86
Conditions at workplace	1.195	0.92-1.56	0.627	0.40-0.99
Relationship with supervisor and co-workers	1.033	0.80-1.33		
Work burden	0.896	0.73-1.10	0.789	0.61-1.03
Professional development opportunities	1.752	1.27-2.42	1.912	1.26-2.90
Basic salary	1.213	0.94-1.57		

^a All factors were entered into the multivariable model and then stepwise selection was used to remove from the full model those with $p > 0.3$.

OR=odds ratio; CI= confidence interval

Discussion

Almost half (n=120; 47.8%) of anesthetists said they planned to leave the job in the next year. Comparable data from other LMICs are rare, but a study in Thailand found similarly high levels of turnover intentions among nurse anesthetists [20]. Yet evidence suggests that most health workers do not act on stated turnover intentions. For example, actual annual turnover among midwives in Senegal was just 9%, even though 58.9% reported their intention to quit within a year [21]. In Ethiopia, 59.4% of all health workers at hospitals and health centers in Jimma zone intended to leave their jobs in the next year or two compared with actual turnover of 45.9% over five years [22]. A record review in East Wollega zone found an annual attrition rate of 19.3% for health workers holding diplomas or first degrees [23]. A 2012 baseline study conducted for the HRH Project found a 4% attrition rate for anesthetists in Ethiopia [24].

Even if personal relationships, limited job opportunities, or other factors prevent public-sector anesthetists from quitting, high turnover intentions signal that they are dissatisfied with their jobs and may be less motivated to perform well [25–27].

Therefore, the situation in Ethiopia demands action regardless of actual turnover levels, which this study did not document. The multivariable analysis identified five predictors of turnover intentions which can help devise effective strategies to reduce dissatisfaction and promote retention.

Intentions to leave the job declined with increasing age, confirming two studies of nurses in Ethiopia [14, 28]. Researchers have consistently found an inverse relationship

between age and turnover intentions among nurses [18], and a multi-country study found that actual turnover among health workers over age 50 was half that of those under age 30 [25]. Younger health workers have fewer family ties and may leave a job to further their education or career. Compulsory service programs are designed to increase retention among this cohort but have a mixed track record [29, 30]. In this study, the government service obligation did *not* predict turnover intentions, suggesting that other interventions are needed to retain younger anesthetists.

Turnover intentions were about twice as high at district hospitals as at regional and referral hospitals, even after controlling for variables related to living and working conditions. Attracting and retaining health workers at rural facilities like these is especially challenging and often requires special measures, such as recruiting students from and training them in the rural areas where they will be deployed, offering incentives for rural postings, and improving living and working conditions at rural facilities [31–33]. HR managers in Ethiopia should consider these kinds of interventions to retain anesthetists at district hospitals.

Turnover intentions increased with perceived importance of living conditions, which is consistent with previous studies. Inadequate living conditions increased job dissatisfaction and migration in Bangladesh [31], and housing had the greatest impact on non-physician health professionals choosing jobs at public health facilities in Mozambique [32]. The findings suggest that strategies such as housing allowances and

improved access to water and electricity may reduce turnover intentions. Currently in Ethiopia, incentives related to housing are primarily directed to physicians.

Turnover intentions also increased with perceived importance of professional development opportunities. A study in Jimma Zone identified lack of ongoing skills development and training as leading reasons frustrating retention of hospital and health workers [22]. A survey of anesthetists at 41 hospitals in Ethiopia found they had very limited access to refresher training, continuing professional development, and support from a physician anesthesiologist [34]. Lack of coaching and continuing education are common concerns expressed by anesthesia providers in other LMICs as well [4, 35, 36]. The findings suggest that expanding opportunities for coaching, continuing education and advanced degrees may promote anesthetists' retention.

Contrary to expectations, turnover intentions declined with perceived importance of conditions at the workplace. Studies have documented serious deficits in supplies, equipment, and infrastructure for anesthesia in Ethiopia [11, 34], and the global literature suggests these deficits dampen morale of anesthetists in many LMICs [9, 35]. It is possible that the lack of internal consistency in the items making up this factor (which included safety and utilities as well as supplies and equipment) affected the results. Further investigation is needed to interpret this finding.

Researchers have applied the same tools and analytical approach used in this study to examine predictors of turnover intentions among nurses in Ethiopia [14]. Like

anesthetists, half of nurses (n=213; 50.2%) intended to leave the job in the next year. Few studies have compared turnover intentions of different health worker cadres, but they, too, found no significant differences [25, 37]. However, these studies only compared the levels, not the determinants, of turnover intentions. Notably, Ethiopian anesthetists have only one significant predictor of intention to leave in common with Ethiopian nurses: limited opportunities for professional development. For nurses, the two other significant predictors in a multivariable analysis were holding a university degree and fewer years of service. The divergence between anesthetists' and nurses' findings highlights the importance of separately assessing health worker cadres and tailoring retention strategies to each cadre's different situation to ensure their effectiveness.

This study fills an important information gap, because anesthetists have been a largely overlooked and understudied cadre. The large sample provides nationally representative information for policy making, but has some limitations. It did not include the private sector or ask whether respondents intended to leave the facility, the public sector, the country, or the profession – which may be driven by different factors. A further round of data collection to determine whether anesthetists acted on their turnover intentions could have produced actionable information on individuals most at risk of quitting.

Conclusions

High turnover intentions signal that anesthetists in Ethiopia are dissatisfied with their jobs and may suffer from low morale and motivation even if they do not actually quit. Findings suggest that the compulsory service requirement only delays anesthetists' exit from the public health system and that salary is not a significant predictor of their decisions. Strategies that focus on improving living conditions for anesthetists and expanding opportunities for professional development are likely to prove more effective. Age and location also matter: anesthetists are more likely to plan on quitting when they are young and if they are posted to district hospitals. HR managers should consider special measures for anesthetists in these vulnerable categories.

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**Job satisfaction amongst anesthetists in Ethiopia – a national
cross-sectional study**

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Keywords: anesthetists, job satisfaction, Ethiopia, motivation, retention, task shifting

Abstract

Background

Ethiopia has substantially increased production of associate clinician anesthetists. This study aimed to determine the level of, and factors that predict job satisfaction among a national sample of anesthetists.

Methods

A cross sectional study conducted in 2014 sampled 252 anesthetists. Respondents rated 37 items related to job-satisfaction and working and living conditions using a Likert scale, which ranged from 1 (strongly disagree) to 5 (strongly agree). Univariate and multivariable logistic regressions were used to determine factors associated with the main outcome variable, level of job satisfaction. Adjusted odds ratios and 95% confidence intervals were calculated to show the magnitude of associations.

Results

Less than half ($n=107$, 42.5%) of anesthetists were satisfied with their job. Work environment ($aOR = 1.87$, 95% CI = 1.06,3.31), and more than 10 years of experience working in the public health system ($aOR = 4.96$, 95% CI = 1.11,22.13) were predictors of job satisfaction in the multivariable model.

Conclusion

Ethiopian anesthetists have low levels of job satisfaction, with work environment and years of experience being factors that predict their satisfaction positively. Motivation and retention of this cadre will require emphasis on creating a safe and conducive work environment, and interventions designed to motivate junior anesthetists.

INTRODUCTION

There is an increasing global focus on ensuring access to safe surgery, which is currently inadequate in low-resource settings.^{1–4} A shortage of both human⁵ and financial⁶ resources for anesthesia services contributes to the lack of universal access to safe surgical and anesthetic care, and countries have responded by implementing a task-shifting approach^{7,8} developing cadres of associate clinicians who are trained to provide anesthesia.^{9,10}

Ethiopia is an example of a country that has substantially increased training opportunities for associate clinician anesthesia professionals (called anesthetists), in public universities and colleges, enrolling either nurses or high school graduates, who then receive either diploma or bachelor level degree training. Though limited, opportunities for masters' level training are also available for this cadre, leading to a M.Sc. degree in anesthesia.

Increasing the numbers of trained anesthesia providers is not enough – supporting them so that they are motivated and retained is also a priority. Job satisfaction is a predictor of the length of stay in a job, motivation and job productivity,¹¹ and studies have shown correlations between job satisfaction and absenteeism, burn-out and other factors that may affect patient satisfaction.^{12,13}

Health worker job satisfaction has been studied extensively, with study approaches often based on content motivation theories, which consider satisfaction to be an outcome of intrinsic factors such as personal achievement, sense of accomplishment, and prestige as well as extrinsic factors, derived from elements in the work environment such as pay and benefits, working conditions, and resources. Intrinsic factors can be motivating to workers, while extrinsic factors can be demotivating and lead to dissatisfaction.^{12,14–16}

The literature on anesthetists' job satisfaction is limited. A study of Dutch nurse anesthetists found that work climate was correlated to job satisfaction¹⁷, and anesthetic

technicians in New Zealand reported teamwork, practical aspects of the job, clinical management and patient contact as important factors in job satisfaction¹⁸. However, in these contexts anesthetists work under direct or indirect supervision of physician anesthesiologists, which is not the case in many resource-poor settings, where anesthetists are often solely responsible for providing anesthesia care.

In Ethiopia, studies have documented generally low job satisfaction rates for health workers across various cadres. Yami et al found that 46.2% of health workers in the Jimma University hospital were dissatisfied with their jobs¹⁹; a study of midwives in Addis Ababa found an overall mean job satisfaction rate of 52.9%,²⁰ and only 44.2% of providers working at health facilities in Harari region were satisfied with their jobs.²¹ However, none of the studies have included a national sample, and there has been no study focusing on the job satisfaction of anesthetists. This study sought to answer the following questions (1) Are anesthetists working in public health facilities in Ethiopia satisfied with their jobs? What factors are associated with job satisfaction for this cadre?

METHODS

A national cross sectional study was conducted from May 28 to June 14, 2014. A total of 1,354 health professionals working in 227 public health facilities (hospitals and health centers) were included in this study. The study population included: nurses (n = 424), medical doctors (n = 374), anesthetists (n = 252), midwives (n = 177) health officers (n = 127), and health managers (n = 217). This paper discusses results for anesthetists.

Two-stage sampling was used with health facilities as the primary sampling unit and the health worker cadres mentioned above as the secondary sampling unit. Since anesthetists are only available at the hospital level, 108 hospitals were randomly selected using simple random sampling technique (computer generated random numbers) from a hospital sampling frame (list of hospitals in Ethiopia). This comprised 88% of all public hospitals available in Ethiopia at the time of the study.

Using statistical parameters of 95% confidence interval, expected proportion of intention to leave as 0.5, a design effect of 1.2, and a relative precision of 10%, an adjusted minimal sample size of 232 anesthetists was calculated. Given that the total number of anesthetists working per hospital in Ethiopia is small, we invited and interviewed all anesthetists from the sampled 108 hospitals.

Anesthetists were eligible if they were full-time permanent hospital employees, had at least six months of work experience in anesthesia, and were available and willing to participate. No anesthetists were interviewed at four hospitals, either because none were on staff or available at the time of data collection. On average, 2.4 anesthetists (range:1 to 10) were interviewed at each of the 104 hospitals.

Data Collection

A structured researcher-designed questionnaire was used to collect quantitative data on socio-demographic information. Respondents were also asked to rate 37 items related to job-satisfaction and working and living conditions using a five-point Likert scale, which ranged from 1 (strongly disagree) to 5 (strongly agree). The tool was pre-tested on 5% of the planned study population in health facilities and management structures in Oromia region, focusing particularly on comprehensibility and relevance of the questions for all types of health workers included in the study. The instruments were reviewed after the pretest, mainly to clarify the questions, revise sequencing, and adapt the demographic and work-related questions to the Ethiopian context.

Data Analysis

The outcome variable was generated from the response to the statement “considering everything, I am satisfied with my job”. Responses were dichotomized into two categories- “satisfied”, which included the “agree” and “strongly agree” responses, and “not satisfied”, which included “disagree”, “strongly disagree” and “neutral”.

Exploratory factor analysis was performed, but the analysis did not result in useful item classifications. A review of the literature was used to group the 37 items into 8 categories with the potential to predict job satisfaction. These were salary and

benefits, supervision and management, recognition, interactions, professional opportunities, work environment, living conditions and job stability^{12,22}. Cronbach's alpha was calculated to check the internal consistency reliability of items in each category.

Chi-square was used to compute the association in the level of satisfaction between different categorical socio-demographic variables, with a p-value <0.05 to determine statistical significance, and univariate and multivariable logistic regression was used to determine factors associated with our main outcome variable, level of job satisfaction. Adjusted odds ratios (AOR) and 95% confidence intervals (CI) were calculated to show the magnitude of associations.

ETHICAL CONSIDERATIONS

The study protocol received ethical approval from the Johns Hopkins School of Public Health Institutional Review Board, Baltimore, Maryland, (IRB No: 5303), and the Ethiopian Federal Ministry of Health gave permission to conduct the study. Informed consent was obtained from all respondents, and individual identifiers were not used during data collection and analysis.

RESULTS

All categories with Cronbach's alpha greater than or equal to 0.5 were considered for the analysis. One category (job stability) was dropped given a low coefficient (Table 1).

Table 1: Categories for analysis

Category	Items	Cronbach's α
Salary and benefits	1. My salary package is fair 2. My salary is fair compared to other staff with the same level of responsibility 3. My benefits (such as transportation, duty allowance, housing, etc.) are fair compared with other staff at my level	0.656
Supervision and Management	4. My supervisor applies personnel policies and practices fairly to me 5. I have a current work plan developed with my supervisor 6. My annual performance appraisal is based on my work plan 7. My job description is clear and up to date 8. My supervisor is available when I need support 9. The head of this health facility is competent and committed	0.754
Recognition	10. I feel there are sufficient opportunities for promotion with my employer. 11. I receive recognition for doing good work 12. I feel that the organization values my work 13. I feel that the community values my work	0.564
Interactions	14. I have a good relationship with co-workers 15. Overall, the morale level in my team or work group is good 16. I consider myself a part of the local community that I serve as a health worker	0.591
Professional Opportunities	17. I have been given the training that I need to succeed in my position 18. I have access to coaching and mentoring when needed 19. The job is a good match for my skills and experience	0.573
Work Environment	20. The facility takes specific measures to protect me against HIV/AIDS and other occupational hazards 21. My work load is reasonable 22. I have the supplies I need to do my job well and safely) (Such as gloves, needles, bandages, sutures, disinfectants 23. I have the working equipment I need to do my job well and efficiently) (Such as ultra sound, x-ray, blood pressure cuffs 24. This facility has good access to drugs and medication 25. My work space is clean 26. I can take time to eat lunch almost everyday 27. At work, I have access to safe, clean water 28. At work, I have good access to electricity 29. At work, I have good internet connectivity 30. I would encourage my friends and family to seek care here	0.777
Living Conditions	31. At home, I have access to safe, clean water 32. At home, I have good access to electricity 33. I have access to good schooling for my children 34. I have safe and efficient transportation to work 35. The community where I live has good shopping and entertainment	0.566
Job Stability	36. I am not worried about losing my job 37. I intend to continue working here for at least 2 years	0.125

Study participants were primarily male (n= 189; 75%), aged between 30-39 (n=174; 69.1%), and were under a current obligation to work within the public health system (n= 163; 65%). The median number of years of experience in the public health system was 4.1 for all respondents (interquartile range 1.1 – 10.1, data not shown)

Less than half of respondents (n=107, 42.5%) stated that they were satisfied with their job. There was a statistically significant association between job satisfaction and age, current obligation to work within the public health system, and years working in the public health system. (Table 2).

Table 2: Percent of anesthetists who are satisfied with their jobs, by sociodemographic and work-related characteristics, Ethiopia, 2014

Characteristic	All respondents N (%)	Satisfied		P-Value
		N	%	
Number (Total)	252	107	42.5	
Sex				
Male	189 (75)	83	43.9	0.418
Female	63 (25)	24	38.1	
Age in years				
30-39	174 (69.1)	65	37.4	0.014
≥ 40	78 (30.9)	42	53.9	
Place of Birth				
Urban	135 (54)	59	43.7	0.668
Rural	117 (46)	48	41	
Marital Status				
Married	111 (44)	53	47.6	0.132
Not married/Divorced	141 (56)	54	38.3	
Children or dependents				
None	62 (25)	24	38.7	0.750
1 - 2	73 (29)	33	45.2	
3 -4	70 (28)	28	40	
≥5	46 (18)	22	47.8	

Qualification				
First degree or above	164 (65)	71	43.3	0.715
Diploma/TVET	88 (35)	36	40.9	
Type of hospital				
Primary (Zonal/regional)	67 (27)	30	44.8	0.196
General	94 (37)	45	47.9	
Referral	91 (36)	32	35.2	
Upgraded/specialized after the first qualification				
Yes	122 (48)	53	43.4	0.76
No	130 (52)	54	41.5	
Region				
Addis Ababa	38 (15)	14	36.8	0.123
Afar	2 (0.8)	2	100	
Amhara	53 (21)	19	35.8	
Benshangul Gumuz	9 (4)	2	22.2	
Gambela	1 (0.4)	1	100	
Harari	5 (2)	3	60	
Oromia	72 (29)	28	38.9	
SNNPR	45 (18)	21	46.7	
Somali	8 (3)	4	50	
Tigray	19 (8)	13	68.4	
Current obligation to work in the public health system				
Yes	163 (65)	61	37.4	0.029
No	89 (35)	46	51.7	
Experience in the public health system (in years)				
< 1 year	74 (29)	23	31.1	0.011
1-5 years	96 (38)	43	44.8	
5-10 years	38 (15)	14	36.8	
> 10 years	44 (17)	27	61.4	

In a univariate logistic regression, none of the socio-demographic factors were predictors of job satisfaction except having no current obligation to work in the health system (OR = 1.79, 95% C.I = 1.06, 3.02), and more than 10 years of experience working in the public health system (OR = 3.53, 95% C.I = 1.61, 7.69). All intrinsic and extrinsic factors except living conditions were predictors of job satisfaction. (table 3)

Table 3: Factors predicting job satisfaction for anesthetists, univariate logistic regression, Ethiopia, 2014

Category	OR	95% CI for OR	
		lower CI	upper CI
Sex (ref: Male)			
Female	0.77	0.43	1.37
Age in years (ref: <30)			
30-39	1.20	0.11	13.46
≥ 40	2.27	0.20	26.01
Place of Birth (ref: urban)			
Rural	0.90	0.55	1.50
Marital Status (ref: Married)			
Not married/Divorced	1.47	0.89	2.44
Children or dependents (ref: none)			
1 - 2	1.24	0.63	2.47
3 -4	1.06	0.52	2.13
≥5	1.45	0.67	3.14
Upgraded/specialized after the first qualification (ref: yes)			
No	0.93	0.56	1.54
Qualification (ref: 1 st degree or above)			
Diploma/TVET	0.92	0.54	1.55
Type of hospital (ref: primary hospital)			
General hospital (zonal/regional)	1.13	0.60	2.12
Referral hospital	0.66	0.35	1.25

Current obligation to work in the public health system (ref: yes)			
No	1.79*	1.06	3.02
Salary and benefits	1.57*	1.13	2.20
Supervision and management	1.86*	1.36	2.54
Recognition	1.86*	1.34	2.57
Interactions	1.81*	1.19	2.75
Professional opportunities	1.42*	1.08	1.85
Work environment	2.39*	1.58	3.64
Living conditions	1.27	0.97	1.68
Experience in the public health system (in years), ref <1 year			
1-5 years	1.80	0.95	3.40
5-10 years	1.29	0.57	2.94
> 10 years	3.52*	1.61	7.69

*p value < 0.05

Only two factors remained a predictor of job satisfaction in a multivariable logistic regression: work environment (aOR = 1.87, 95% CI = 1.06,3.31), and more than 10 years of experience working in the public health system (aOR = 4.96, 95% CI = 1.11,22.13) (table 4).

Table 4: Factors predicting job satisfaction for non-physician anesthetists, multivariable logistic regression, Ethiopia, 2014

	Adjusted OR (aOR)	95% CI for aOR	
		lower CI	upper CI
Salary and benefits	1.20	0.82	1.76
Supervision and management	1.22	0.81	1.83
Recognition	1.41	0.89	2.24
Interactions	1.04	0.63	1.72
Professional opportunities	0.98	0.70	1.35
Work environment	1.87*	1.06	3.31
Living conditions	0.97	0.69	1.37
Current obligation to work in the public health system (ref: yes)			
No	1.44	0.74	2.80
Experience in the public health system (ref: < 1 year)			
1-5 years	2.18	0.69	6.88
5-10 years	1.59	0.46	5.53
> 10 years	4.96*	1.11	22.13

*p value < 0.05

DISCUSSION

Less than half of the anesthetists in Ethiopia reported that they were satisfied with their jobs; other studies of health workers in the country have found comparable evidence,^{19–21} except for one study which found that 79.5% of respondents were satisfied with their jobs²³. Findings from other settings vary, though most have found higher satisfaction levels, including 70.5% of nurses in South Africa,²⁴ 97.9% of community health workers in Rwanda,²⁵ and a range of 69% - 91% for health workers in a rural health facility in Vietnam²⁶.

Our study found that the work environment is a predictor of job satisfaction for Ethiopian anesthetists. This category included factors related to access to a clean and safe working environment, adequate working supplies and equipment, protection against occupational hazards, and the opportunity to have resting breaks. A systematic review²⁷ found that nurses working in units with good environments presented higher job satisfaction, lower burnout, and lower intention to leave. Findings specific to anesthesia professionals are limited and mainly report on the workforce in high-resource settings. A non-systematic review article found that control of the work environment was one of the most relevant factors in job satisfaction for physician anesthesiologists²⁸, and a Dutch study of anesthesia teams found that nurse anesthetists were more likely to rate work conditions as being related to job satisfaction when compared to anesthesia specialists and trainee anesthetists (specialists)²⁹.

Anesthetists in low-resource settings often have to work in challenging work environments, with limited equipment and supplies such as water, electricity, oxygen and analgesics³⁰. Though providers in these settings have applied innovative approaches to improve working conditions such as using buckets of water (when no running water is available), using back-up generators or torches or mobile phone lights when there is no electricity, and working with nurses or family members to manually ventilate patients,³¹ policy makers and other stakeholders must prioritize ensuring the availability of these basic supplies.

Additional efforts should focus on creating adequate environments that foster communication, increase participation and autonomy of employees, promote control over work to avoid over-load, and recognize achievements²⁸. Attention should also be paid to the prevention of occupational hazards such as infection, physical injuries and exposure to chemicals and waste. Studies in Ethiopia have also documented high rates of work place physical or verbal abuse or threats among nurses from either co-workers, patients, or patients' families^{32,33} and this should be further addressed, making the work environment more safe.

Working experience in the public health system was also found to be a predictor of job satisfaction, with anesthetists who had more than 10 years of working experience being more likely to be satisfied with their jobs. This corroborates findings from similar studies^{34–36}, and may be because junior staff often have to work less desirable shifts and longer hours, may not be selected for continuing professional development activities, and may have less autonomy and leadership opportunities. It may also be that junior professionals are not aware of organizational policies and programs to enhance motivation. Conversely, older employees may have become accustomed to and accept organizational policies and programs, and are paid higher salaries due to longer years of service. Efforts should be made to design targeted interventions to address motivation for junior anesthetists, including ensuring that they are informed about and aware of existing employee-wellness and motivation programs.

Mentorship of junior health workers by more experienced ones has been shown to positively influence job satisfaction³⁷ and should be considered in this context, including creating structured mentoring and coaching systems that will allow more experienced anesthetists to support and positively influence new anesthetists.

LIMITATIONS

The authors are not aware of any other national study looking at anesthetist job satisfaction in Ethiopia or in any other low resource setting. This paper fills an important gap in the literature. The national sample is representative, but did not include providers working in the private sector. The study did not use a standardized and validated study tool, and relied on a single question to measure job satisfaction. Additional studies to determine the effect of job satisfaction on the quality of patient care can provide further insights that will inform design, implementation and monitoring of strategies to improve the work climate for this cadre.

CONCLUSION

Empirical evidence on health worker satisfaction rates can be useful in informing policies and strategies to reduce attrition, and improve performance. Ethiopian policy makers and managers should be alerted by our findings and they should pay attention to the motivation and retention mechanisms for a substantial number of anesthetists. This is even more important considering the government's plan to invest significantly in training new professionals for this cadre, as outlined in the new Human Resources for Health (HRH) Strategy, which includes explicit targets to increase the number of trained anesthetists to 3,284 by 2020 and 5,769 by 2025³⁸.

Efforts to motivate and retain this cadre of providers will require emphasis on creating a safe and conducive work environment, and interventions designed to motivate junior anesthetists. An enhanced level of staff satisfaction with the work environment will likely spill also over onto clients and increase satisfaction with service quality³⁹.

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CHAPTER SEVEN

DISCUSSION

Given the significant shortage of physician anesthesiologists, Ethiopia has adopted a task shifting approach, and successfully expanded training for associate clinician anesthetists. For a population of over 97 million, Ethiopia plans to increase the number of physician anesthesiologists to 108 by 2020, and to 183 by 2025. The targets for associate clinician anesthetists are much higher, with the plan being to increase anesthetists to 3284 by 2020, and 5789 by 2025. The government's national plan also includes a strategic action to *"regularly review the needs and develop strategies/actions for task shifting to address critical shortages of health professionals"*²⁷.

The findings in this thesis provide a cohesive picture of the education, training, current practices, and motivation of anesthetists in the country. The first research question asked *"Are anesthetists in Ethiopia adequately prepared to provide anesthesia services?"* In **Chapter two**, in a study that assessed clinical decision-making, communication, and psychomotor skills using the Observed Standardized Clinical Examination (OSCE) approach, the students' overall mean score was 61.5%. Competence varied across the ten stations assessed, with the mean highest score being for spinal anesthesia (79.5%), and the lowest score for routine anesthesia machine check (36.7%). Overall, graduates from universities scored better than those from colleges (64.5% versus 55.5%, $p = 0.023$), Male students also scored higher than female students (63.2% versus 56.9%, $p = 0.014$). Most of the students felt that the infrastructure and instructors at the institutions were not adequate – less than 10% believed that the skills labs had adequate staff and resources, half rated instructors as effective (50%) and fair (48.4%), and 55.7% felt they had received sufficient practical experience. Most (76.5%) university students met the requirement of performing a minimum of 200 endotracheal intubations, but this number was only 19.5% for college students ($p = 0.018$). Factors predicting student competency were gender (being male), and attending a university training program²⁸.

To complement these findings, **Chapter three** reported qualitative results from instructors, clinical lab assistants and preceptors teaching at midwifery and anesthesia programs. Informants' responses were largely the same for both programs. There was a variation in the robustness of student assessment methods across institutions, suggesting a need for standardization. Many informants (56 of 87, 64%) were critical of the quality and motivation of students, and some suggested basic education reforms, screening procedures, and government-mandated admissions criteria to raise the caliber of entering students. They also felt that the number of students enrolled was too high given the existing resources.

Though informants had generally positive responses regarding the suitability of the curricula, there was almost universal agreement that there was a lack of infrastructure and equipment both in the skills labs and at the clinical practice sites. Over 90% of informants also reported challenges with the clinical education experience, including logistics (lack of student transportation), lack of access to patient cases, and poor coordination and oversight from preceptors²⁹.

In summary, **Chapter two and three** suggest that although the rapid expansion in training for this cadre is impressive and will increase access to care, attention needs to be paid to the quality of pre-service education. The following are recommendations to improve the quality of education for this cadre at the pre-service education level.

Summary of recommendations to improve quality of education for anesthetists

1. Strengthen student selection and address gender disparities
2. Standardize learning outcomes in curricula across institutions
3. Strengthen clinical education
4. Strengthen student assessment and address gender disparities
5. Address gaps in infrastructure and supplies in the learning environment

1. Strengthen student selection and address gender disparities

Chapter three highlighted concerns from some instructors regarding the motivation and merit of students selected to participate in the anesthetist program. In some settings, particularly in LMICs, anesthesia is a generally unpopular career choice. A study of 702 post-graduate anesthesia students in India found that only 42.3% of them joined the speciality out of interest and wished to make it their career. A majority of them joined for other reasons, including unavailability of other specialties they preferred. Even more relevant to this thesis, 74% of the diploma candidates in this study regretted their choice, and 92% of them wanted to pursue an additional degree such as a medical degree (MD) in anaesthesia. Reasons included less opportunities in teaching institutions and metro cities and discrimination against diploma candidates compared to MD candidates³⁰. Similar results were reported in Benin, Rwanda and Pakistan, where the respondents (medical students) perceived the anesthesia speciality to be unchallenging, non-lucrative, stressful, and have low prestige and minimal interaction with the patient³¹⁻³³.

As a first step then, training institutions and other stakeholders should pro-actively provide students with opportunities to be exposed to anesthesia as a profession, so that they get a better understanding of it

before they join programs. Schools and hospitals can organize “open days” where potential students spend time shadowing anesthetists and learning more about what they do. Practising anesthetists can also share their experiences with potential students in different forums such as recruitment drives, radio shows, and social media.

Institutions should then focus their efforts on selecting the right students – those who are motivated, interested and have the potential for academic success. Though studies have shown that grade point averages (GPA) are predictive of academic success, institutions should not rely only on this criterion. A student, who may not have any interest whatsoever in becoming an anesthetist, should not be assigned to a program purely because they meet a minimum grade threshold. Similarly, a promising student who is highly motivated and interested in the career should not be turned away based on the criteria of GPA only.

Studies have examined other student characteristics that should be considered for recruitment. One study surveyed clinical and academic faculty in the US to determine their perceptions of the personality characteristics that are attributable to clinical success and safe nurse anesthesia practice. They identified 17 intrapersonal and 4 interpersonal characteristics that were beneficial for safe nurse anesthesia practice (example “being vigilant”, or “accepting responsibility for actions”), whereas 20 intrapersonal and 3 interpersonal characteristics were seen to be associated with unsafe nurse anesthesia practice (example “lacks integrity” or “unable to concentrate”)³⁴. Given the often challenging working conditions that anesthetists may have to face, characteristics such as altruism, commitment, patience, and creativity should be considered when selecting students.

Criteria should also consider the candidate’s ability to cope with stressful work environments. Roberts et al looked at how to measure response to stress for doctors applying for post-graduate anesthesia programs in the United Kingdom (UK). They asked candidates to evaluate their anxiety before completing tasks at selected stations during the applicant exams, and report whether they felt “threatened” or “challenged”. A “challenge” state was associated with superior performance on a station when compared to a “threat” state. Further work should be done to identify ways of measuring applicants’ coping mechanisms for stress³⁵.

Training institutions should research, analyse and adapt existing evidence and develop country-specific criteria for student selection that incorporate grades, student characteristics and cultural norms. This includes consideration of gender disparities. Ethiopia uses affirmative action strategies to recruit female students, who traditionally have had barriers to accessing and successfully completing higher education programs. While useful and needed, implementation of these affirmative action strategies should

be balanced with ensuring a match with students' interests and aptitude. More importantly, emphasis should be made on ensuring that female students are adequately supported and encouraged during the early stages of their education so that they do better on exams, thus minimizing the need for affirmative action during enrolment. As an example, female students should be allowed to study in the evenings instead of performing house work, exposed to positive role models of other females who have excelled academically, and encouraged to speak up and voice their opinions during class room discussions. This will require awareness-raising and outreach to parents and/or guardians, as well as elementary and high school teachers. This messaging can be coordinated by the Ministry of Women and Children Affairs, and implemented by stakeholders such as civil society.

2. Standardize learning outcomes in curricula across institutions

Trainers had generally positive feedback regarding the curricula for this cadre of associate clinicians, but there are differences in the types of curricula being used in the various institutions, as well as differences in how they are implemented. Similarly, there are differences in the assessment of students, with some schools relying on reports from clinical preceptors to assess student competencies, while others provide structured institutional OSCE exams.

These differences are to be expected, given the autonomy of each individual institution. However, whichever the approach used by each institution, universal learning outcomes and competency standards must be set across all programs, and attained by students. Anesthetists should not have dramatically different learning experiences based on the institution attended, and they should all certainly be prepared to demonstrate competencies required in their professional scope of practice regardless of institution attended.

Educators, practitioners, policy makers and students must work collaboratively and participate in routine national **reviews and revisions of curricula** across institutions. The aim of the reviews should be to check for appropriateness and clarity of learning outcomes, linkages to scopes of practice, and relevance due to changes in population needs and epidemiological trends. Representatives from other cadres that work closely with these associate clinician anesthetists (such as physician anesthesiologists, surgeons, obstetricians, nurses) should also be invited to these review meetings. Similarly, anesthetists must make efforts to participate in national curricula review discussions for other cadres given the requirement for a team approach during surgery. Students must also be given a voice during this process, because who are

better than they to provide insights about their own learning! This can be done by inviting selected students from various institutions to contribute to discussions and review documents.

LMICs should resist the temptation to “copy-and-paste” curricula from western countries. Though institutions in Ethiopia currently make efforts to “contextualize” and “adapt” curricula and other learning materials, these activities should go beyond making minor modifications which mainly address cultural contexts. Significant thought and time should also go into appropriately revising scientific and clinical protocols which are often tailored for settings with sophisticated equipment and infrastructure. This process should inspire innovation – there are opportunities for LMIC educators to come up with low-cost technologies/processes/protocols that can address their specific country and resource contexts.

Gender-responsive pedagogy should also be implemented, ensuring that learning materials and examinations are not skewed towards either male or female gender stereotypes. As an example, in drafting case studies to be included in a textbook, care should be taken to ensure that all “senior” staff are not all male, which all “supporting” staff are female.

Finally, efforts to strengthen curricula should also consider opportunities to share experiences with other countries. There are a number of efforts to support anesthetist trainings in the East African region, with partnership from western countries, such as the Vanderbilt¹ International Anesthesia Program in Kenya and the Muhimbili-Karolinska² Anaesthesia & Intensive Care Collaboration in Tanzania. Cross-country collaborations should be encouraged and facilitated so that experiences, expertise and learning materials can be shared.

In line with curricula reviews, further research should be conducted to investigate the various **types of training programs** (one year at colleges versus four years at universities) and student profiles (high school graduates versus nurses) enrolled in each. In **Chapter two**, being a university graduate was positively associated with competency. Universities enrolled a higher proportion of students, who were also younger. Students at universities were also more likely to complete the minimum required number of endotracheal intubations, thus suggesting better access to clinical practice opportunities, though students in colleges were more likely to believe that preceptors were available at practicum sites.

These findings confirm the literature. One study found that as critical care nursing experience increased prior to enrolment in a nurse anesthesia program, performance (GPA) of students decreased³⁶. Another study found that US nurse anesthetist candidates with baccalaureate degrees scored higher on a

¹ An American based university

² A Swedish based university

certification exam than those with diploma or associate degrees³⁷. Students enrolled in anesthesia programs in Ethiopian colleges have prior clinical experience, often as nurses. Further research can determine whether their low performance could be because they have been away from the academic setting longer, or for other reasons. This information can then be used to design and offer targeted support for students enrolled at colleges.

The Ethiopian Higher Education Relevance and Quality Agency (HERQA), has developed national standards for anesthesia degree programs. These standards “provide a framework against which anesthesia schools can measure themselves, identify gaps, and implement quality enhancement programs”³⁸. Universities should prioritize use of these standards as a tool to routinely review and improve their performance in teaching.

3. Strengthen clinical education

A common theme in both **Chapter two and three** was lack of access to adequate practice opportunities for students at clinical practice sites. Challenges included poorly prepared preceptors, lack of coordination between institutions and practice sites, lack of transport, and lack of adequate caseloads and mix.

Addressing these challenges requires substantial long-term investments. Schools must budget for, procure and maintain vehicles to transport students, facilitate training and update preceptors, and expand access to hospitals and health centers so as to increase caseloads for students. In the short term, institutions should look into cost-effective and innovative approaches to address these challenges. This could include collaborating with private sector hospitals to increase access to cases, using rotations (including night shifts with security provided for students), and providing incentives for practicing anesthetists who offer to coach and mentor students as preceptors during off-hours.

It is worth mentioning that **Chapter two** found that students from colleges performed far less endotracheal intubations than their university counterparts, yet scored higher on this skill during the OSCE. Further studies should be conducted to examine the factors associated with higher scores among college students despite their limited opportunities to practice.

Finally, it must also be considered that sophisticated clinical protocols for obstetric (and other specialties) anesthesia are often developed in high income countries, and these should be reviewed and tailored to contexts where resources are not adequate. This calls for translational research to develop and test management strategies in the specific environment in which they will be used. As an example, for the

prophylactic use of uterotonic agents for postpartum hemorrhage (PPH) following cesarean delivery, South African guidelines offer a management option for a low resource setting (earlier use of intramuscular ergometrine and a bolus of intramuscular oxytocin following delivery of the neonate, to be repeated four hours later if necessary), and for a high resource setting (an eight-hour postoperative oxytocin infusion)³⁹. Malaloe et al also report the experience of adapting international guidelines for intrapartum care in Zanzibar through involving local stakeholders⁴⁰.

4. Strengthen student assessment and address gender disparities

Study participants assessed in *Chapter two* had already passed their institutional exams, yet their overall mean score on the OSCE was 61.5%. This calls for improving current institutional assessments so that they can verify that students have mastered the required skills before graduation. Wunder et al describe the experience of incorporating an OSCE approach into the assessment processes of a nurse anesthesia program in the US. Though the process requires an investment in planning, ensuring availability of simulation models and mannequins, orienting standardized patients, and developing questions, it is an effective way to assess student skills. The authors also suggest the use of an OSCE during the mid-point of training, and then another OSCE towards the end, to document progression and to identify gaps in skills' acquisition⁴¹. Institutions in LMICs should consider incorporating the use of OSCE or other simulation-based assessment methods, and then support students to prepare adequately for the exams by allowing them to have access to learning materials, coaching, and structured peer support groups. Efforts to mitigate unintended consequences (e.g. faculty facing pressure to have a certain percentage of their class passing, thus being lax in the administration of exams) should be well thought out. There should be no penalties for faculty when students do not pass. It would be better to provide incentives when students demonstrate progression and improvement over time, or, when scoring in institutional exams matches scoring in external assessments such as the national certificate of competence or licensure exam.

Female students scored lower than males in OSCEs, a finding that differed from many studies in the literature^{42,43}. This calls for support to female students as they learn and prepare for examinations (peer support groups, addressing barriers to studying such as concerns for safety while studying at libraries in the late evenings). Additional research can also help to identify reasons for this difference in performance.

5. Address gaps in infrastructure and supplies in the learning environment

Gaps in the learning environment were highlighted as being substantial. This is not a surprise, given the rapid expansion of these training institutions in the context of limited resources, thus having to prioritize quantity as compared to quality. Efforts to address these gaps must be practical – while soliciting donations from donors can help, equipment that is donated must be suitable for the setting – it is not helpful to obtain a high fidelity simulation model or machine to be used for training, yet once the graduate is placed in a hospital, such equipment is not available.

Partnerships with the private sector can also help to develop low-cost technologies that will address persistent shortages of supplies, both at the schools, and at the clinical practice sites. Consumables such as buckets and gloves for infection prevention can be manufactured locally at vocational enterprises for a fraction of the costs.

Strengthening national supply chain management processes should also continue to be a priority.

The second research question was, “*Are anesthetists in Ethiopia adequately supported to provide anesthesia services?*” **Chapter four** provides insights on the current practices of deployed anesthetists and identifies areas for strengthening regulations and training. **Chapter five and six** highlight issues that can affect motivation and retention of anesthetists, and identifies elements that should be targeted to improve job satisfaction and reduce attrition levels.

In **Chapter four**, the majority of practising anesthetists reported that they were adequately trained, and could competently provide services according to their scope of practice. This is encouraging, and is similar to results in Ghana⁴⁴. It is remarkable that the sample of students who were assessed in **Chapter two** did not meet all the competency requirements, yet practicing anesthetists perceived themselves to be competent. This could be simply explained by the fact that the cohorts studied were different, or that once deployed, anesthetists gain skills on-the-job, but it warrants further investigation as there could be a gap between perceived competency and actual performance. In **Chapter five**, almost half of anesthetists planned to leave their job in the next year. They rated basic salary and professional development opportunities as the most important factors affecting their decision to leave, though in a multi-variable regression, predictors of turnover intentions were age (intention to leave declined with increasing age), and working at district hospitals (anesthetists at referral hospitals were half as likely to intend to leave the job as those at district hospitals).

Turnover intentions also increased with perceived importance of living conditions; the same was true for opportunities for professional development. This pattern was reversed for conditions at the workplace: anesthetists who considered this factor more important were less likely to intend to leave the job.

Chapter six examined job satisfaction for this cadre. Less than half of respondents stated that they were satisfied with their job. There was a statistically significant association between job satisfaction and age, current obligation to work within the public health system, and years working in the public health system. Only two factors remained as positive predictors of job satisfaction in a multivariable logistic regression: more than 10 years of work experience in the public health system, and work experience.

In summary, **Chapters four to six** suggest that although task shifting of anesthesia services to associate clinician anesthetists is working, various strategies and interventions are required to provide an enabling environment that facilitates their performance and retention.

Summary of recommendations to improve the enabling environment for task shifting anesthesia services

6. Strengthen governance and regulation of anesthetists
7. Increase professional stature of anesthetists
8. Implement strategies to motivate and retain anesthetists

6. Strengthen governance and regulation of anesthetists

Different governance and regulation models can influence task shifting in a given country. Governance encompasses the “structures and processes through which policies (formal and informal) are enacted to achieve goals, while regulation refers to legally binding policy instruments that set rules and limit entry to a profession or practice, such as by licensing and credentialing specific cadres of health professions⁴⁵. Governance and regulation can either act as a barrier to task shifting, such as when national protocols prevent a cadre from performing certain tasks (e.g. not allowing midwives to perform cervical cancer screening), or as enablers, such as when policies are implemented to motivate health workers. Examples of poor governance for human resources for health (HRH) include health workers referring patients to their own private clinic, task shifting not being regulated, and global health initiatives causing health workers to neglect their tasks for the benefit of the priority vertical programs⁴⁶.

A systematic review found that policy makers designing governance and regulation strategies often have the end goal of improving patient outcomes or reducing financial costs. Though this is of course a priority, the studies reviewed suggested that policies often were not explicitly aimed at improving health

workforce outcomes (such as job satisfaction or motivation)⁴⁷. In designing task shifting policies, efforts need to be made to ensure that they consider not just patient outcomes, but also health workforce outcomes and productivity.

Of course, for governance and regulation to work, strong transparent leadership is required, and efforts have to be made to engage the health workforce as key stakeholders through-out the process (design, implementation, monitoring). The importance of good leadership cannot be overstated – many reasonable and well-intended policies have failed due to lack of it. Governments should focus on processes that identify promising leaders, nurture and train them, and then hold them accountable. The Ethiopian government is already doing this to a certain extent. Leaders of hospitals which are selected for high performance are often rewarded with incentives or promotions. This should be expanded and strengthened by providing similar recognition and incentives for leaders within the health sector who successfully lead their teams in implementation of policies.

Licensure exams are an effective tool for regulation. Ethiopia has recently launched a new system to test anesthesia students graduating from public universities (and other priority health cadres such as doctors and midwives). To date, with support of the HRH Project, a fully functional department within the Ministry of health has been established and will be responsible for this process, called the National Board of Exams. Data from the HRH Project shows that the Ministry has also developed exam questions and tested 212 anesthesia students (Table 2).

Table 2: Results of the licensure exam for anesthesia graduates, Ethiopia, 2017

Academic year	No. of students who took the exam	Cut-off point (%) (Pass score)	Overall pass rate (%)
2015	116	50	94 (81%)
2016	96	46	83 (86%)
Total	212		

Licensure exams will ensure that new graduates are assessed in a standardized manner, and can demonstrate their capacity to provide anesthesia services before being declared ready for deployment. **Chapter four** identified specific tasks that anesthetists said they were not trained to perform during pre-service. These were mainly non-technical skills, such as “Plan and maintain adequate stocks of anesthetic drugs and supplies”, and “uphold infection prevention standards”. These tasks should be appropriately addressed during curricula revisions and teaching, and also incorporated into licensing exams.

Monitoring and evaluating maintenance of competency for anesthetists beyond their initial licensure is also important. **Continuing professional development (CPD)** for this cadre is particularly relevant given the gaps in knowledge and skills that were identified in certain tasks such as “preoperative screening assessment” and “blood transfusion” during the student competency study. Efforts should be made to offer in-service training and other CPD opportunities based on identified gaps.

The anesthetist **scope of practice** is another area that should be considered as part of regulation. The scope of practice must be rooted in the reality of the context anesthetists are working in. Given that they practice almost always alone, scopes of practice should be carefully reviewed to ensure expectations are clearly outlined and match job descriptions, work burden is considered, and tasks match their pre-service training⁴⁸. Referral protocols should also be clear and accessible to the entire surgical team.

Practicing anesthetists, including those working in the private sector, should have a voice and must be part of policy decision making related to scopes of practice. This is already happening in Ethiopia through the participation of the Ethiopian Association of Anesthetists (EAA), the association for associate clinician anesthetists, at government led policy meetings. This should be further encouraged by developing systems that require inputs and buy-in from the Association before any key changes are made to the scope of practice.

Once the scope of practice is finalized, it must be clearly communicated and available not only to anesthetists, but also to other health workers, particularly the surgical team. They should all have a clear understanding of what the associate clinician anesthetist (versus the physician anesthesiologist) is expected to do, which can minimize role confusion and also serve to protect anesthetists so that they are not asked to perform tasks outside of their scope. Systems should consider enforcement when there is malpractice and anesthetists operate outside of their scope of practice. Enforcement should be supportive when needed (if breach is determined to be due to human error), or punitive (if breach is due to professional negligence).

Attempts to harmonize scopes of practice across countries can help with future regional migration. A nurse anesthetist in Ethiopia should be able to practice in neighboring countries and vice versa, given the expectation that in the future regional travel and migration is likely to increase.

Finally, governance and regulation will be driven by **data**. As countries work to strengthen national health statistics data and health information systems, documentation of the contribution of anesthesia-related morbidity and mortality should not be left out. This data, which can be collected as part of maternal death audits or other similar processes, should be reported to local professional associations, the Ministry

of health, and the Ministry of education, who should all collaborate to analyze and use the findings to guide revisions in anesthesia scopes of practice, CPD, and supportive supervision.

7. Increase professional stature of anesthetists

The profession of anesthesia has a low status in many LMICs. As a result, it often relies on a technician based system with poor image, low wages, inadequate equipment, and conditions that limit professional development⁴⁹. This is further complicated by the sometimes contentious relationship between physician anesthesiologists and associate clinician anesthetists. Although there is a substantial difference in their educational requirements, there is much overlap in the work they do. However, there are also big differences in the earnings and perceived “power” between them, which can cause misunderstanding and conflict⁵⁰. Before addressing strategies to increase the stature of the profession as a whole, the two groups must first strengthen their cohesiveness and collaboration.

This can happen in a number of different ways. First, linkages, support and collaboration between physician anesthesiologists (who are part of the Ethiopian Medical Association) and anesthetists (who are part of the Ethiopian Association of Anesthetists) should be strengthened. The two groups should seek to meet routinely and discuss common agendas (such as collaborating to contribute to national policies and strategies for the profession, creating public awareness of the field of anesthesia). The two cadres should also seek to establish supportive mechanisms to share experiences and review difficult cases. Anesthetists perform the largest number of services, and will have valuable insights that can also inform the practice of anesthesiologists, and anesthesiologists will likely have access to complicated cases which can also be informative to anesthetists. This can be done through the use of telemedicine facilities (which the ministry of health facilitates), or simpler platforms such as WhatsApp or Facebook groups.

Second, the two groups should pro-actively seek to provide combined inputs into research agendas on HRH issues, thereby ensuring that the profession as a whole is not left out of research. This can include active engagement with national institutes that are tasked with research (such as the Ethiopian Public Health Research Institute), as well as research departments at universities and colleges.

Other concrete efforts should be made to increase visibility of anesthesia overall as a profession. **Chapter four** found that many anesthetists rated themselves as unable to perform tasks related to inter-professional collaboration and communication, professionalism, management and leadership, and scholarship, or said they did not frequently perform these tasks. Health facility managers and leadership

should seek opportunities to include anesthetists in institutional technical working groups or committees that focus on professional activities such as quality improvement or leadership training.

Anesthetists should also make efforts to educate the community about anesthesia and its role in surgery by routinely joining teams that provide outreach and education. Anesthesia is often poorly understood and therefore often scary to people, thus providing basic information that corrects myths is important. Pre-surgical counselling when feasible should also take place with anesthetists providing clear and simple explanations to patients about what they can expect to happen during procedures.

8. Implement strategies to motivate and retain anesthetists

Findings from **Chapter five and six** signalled that focus on motivation and retention of anesthetists is required. These findings were not unique to this cadre – 60.8% of nurses⁵¹, 39.2% of physicians and 48.8% of associate clinicians (health officers) in Ethiopia said they were satisfied with their jobs⁵². However, **Chapter five** highlighted the fact that predictors of intention to leave for nurses and anesthetists were not the same, suggesting that it is important to tailor specific motivation and retention strategies for each cadre. Anesthetists' opinions regarding which financial and non-financial incentives should be obtained during annual meetings of the association (surveys), or through routine surveys conducted at the health facilities where they work. They should also be invited to meetings where leaders are discussing implementation of motivation strategies.

The government of Ethiopia has outlined a number of both financial and non-financial motivation and retention strategies for health workers in its strategic plans, but these are not always uniformly applied. As an example, the plan to offer housing benefits for health workers is primarily targeted to physicians. Given that turnover intentions increased with perceived importance of living conditions for anesthetists, they too should be considered in provision of housing benefits.

Anesthetists working in district hospitals (which are often rural and remote) were more likely to intend to leave their job. Innovative approaches to incentivize them should be explored, including offering lower tax rates to those working in district hospitals, or providing them and their families with internet wireless services (3G network) at drastically reduced prices. In Ethiopia, minimum staffing standards for public health facilities require at least one physician anesthesiologist at each general hospital, and two at specialized hospitals; and three associate clinician anesthetists at primary hospitals, eight at general hospitals, and 14 at specialized hospitals. These facility staffing requirements should be reviewed regularly by health facility managers to ensure that they are based on actual work-load and population served.

Attention should be particularly focused on younger anesthetists. Clear pathways for career growth may help, as will fair and transparent mechanisms to access educational opportunities. Criteria for who gets selected for educational opportunities should be developed collaboratively with inputs from the government, institutions and anesthetists themselves. To facilitate transparency, these criteria should then be made available to all and posted in surgical wards or staff offices, and the selection process documented and made available to anyone who requests for it.

As stakeholders work to improve motivation and retention, they should also aim to routinely measure attrition rates; associations between turnover intentions, job satisfaction and actual attrition rates will be useful to guide future policy making.

CONCLUSION:

Task shifting will continue to be a necessary and important strategy in addressing HRH shortages in LMICs. Task shifting of anesthesia services is feasible and effective, but requires adequate investments in ensuring that the associate clinicians are effectively **prepared** and **supported** to conduct activities within their expanded scope of work. This means that the right students should be enrolled, taught using relevant and standardized curricula, and provided with adequate opportunities and support to practice and gain competence. Graduating anesthetists must then be examined and declared proficient before licensure and deployment, and thereafter provided with an enabling environment that will enhance their performance, productivity, and motivation.

These concepts are not new or unique, and this thesis demonstrates that the solutions are known, have been studied individually, and can be applied to task shifting not only for anesthetists, but also for other cadres as well. What is less straight-forward is the “how”. Comprehensive application of all these strategies, using a health systems approach, requires resources, which are limited, good leadership, which is sometimes lacking, and time. Attempting to prescribe a uniform or “one-size-fits-all” approach to maximizing synergies between various actors to strengthen health systems is unlikely to work given contextual differences⁵³.

Task shifting should be implemented alongside other long-term efforts to address overall health workers' shortages. A 2013 survey of all Ethiopian surgical residency training graduates since the program's inception in 1985 found that a total of 348 Ethiopians had been trained in surgery, and of those, 75.8% continued to practice in the country⁵⁴. Similar efforts should be made to increase the number of physician anesthesiologists, and other cadres that comprise the surgical team. This could be done by

partnering with institutions (e.g. in South Africa) that can offer technical support and residency opportunities for anesthesiology via exchange programs.

As health systems continue to grapple with resource shortages, innovative approaches to safely task shift appropriate activities to patients must also be considered. As an example, women could take a vaginal self-sample which is then taken to a health facility to be used for HPV DNA testing for cervical cancer screening, thus eliminating the role of health workers for sampling⁵⁵.

Countries such as Ethiopia can achieve effective implementation of all strategies and interventions required to facilitate task shifting, by building upon the considerable progress made to date in education and training, taking advantage of rapid economic growth, and prioritizing effective leadership and stewardship by leaders in the public health sector.

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CHAPTER EIGHT

SUMMARY

This thesis aims to answer the following main research question – has task shifting to anesthetists in Ethiopia increased access to safe anesthesia services?

Chapter One provides an introduction to the thesis, and provides the context and evidence for the problem statement addressed. The introduction highlights the global burden of surgical disease and lack of access in resource-poor settings, the shortage of a health workforce to provide anesthesia services in these settings, and the task-shifting approach that has been used in Ethiopia and elsewhere to address this shortage.

Chapter Two documents the competency levels of graduating anesthetist students, as well as the current status of the infrastructure and other learning materials at the training institutions. A cross-sectional study assessed skills and knowledge of 122 students graduating from anesthetist training programs at six public universities and colleges in Ethiopia, and obtained data on the adequacy of the learning environment. Findings suggested gaps in student performance in various skills, with an overall mean competence score of 61.5%. Male students performed better than female students, as did students from university programs. There were critical gaps in the infrastructure, staffing and resources available to students at the institutions.

Chapter Three examined the perceptions of trainers (instructors, clinical lab assistants and preceptors) towards the adequacy of students' learning experience and implications for achieving mastery of core competencies. A qualitative analysis of in-depth interviews with 78 trainers found common challenges including poorly prepared and un-motivated students, shortages in skills lab and equipment, and limited access to adequate clinical practice opportunities.

Chapter Four looked closely at the tasks performed routinely by deployed anesthetists. A cross-sectional study was conducted with 137 anesthetists working in the public health sector. Overall, respondents felt that they were adequately prepared to perform a majority of the tasks in their scope of practice. The findings identified tasks that should be prioritized in pre-service education and in-service training for this cadre, as well as those that should be included in licensure exams.

Chapter Five analyzed data on anesthetists intention to leave their current job in the next year, which is widely accepted as a predictor of actual turnover intentions. Using a cross-section design, data were collected from 251 anesthetists, of whom almost half (47.8%) planned to leave the job in the next year. This suggests that they may be dissatisfied with their jobs, and may have low motivation. Younger anesthetists were more likely to plan to leave, as were those that were posted at district hospitals.

Chapter Six used a cross-sectional design to collect quantitative data from 252 anesthetists, who were asked to rate 37 items related to job-satisfaction and working and living conditions using a likert-scale. Less

than half (42.5%) of the respondents stated that they were satisfied with their job, with work environment and more than 10 years of experience being a predictor of satisfaction in a multivariable logistic regression.

Chapter Seven presented implications of the studies, and provided recommendations to 1) improve the quality of education for anesthetists, and 2) improve the enabling environment for task shifting of anesthesia services to the association clinician anesthetist cadre. The recommendations are below:

- Strengthen student selection and address gender disparities
- Standardize learning outcomes in curricula across institutions
- Strengthen clinical education
- Strengthen student assessment and address gender disparities
- Address gaps in infrastructure and supplies in the learning environment
- Strengthen governance and regulation of anesthetists
- Increase professional stature of anesthetists

Implement strategies to motivate and retain anesthetists

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And finally, to Judy, and to Joe – I know you are proud!

CURRICULUM VITAE

PROFILE

Over 14 years of professional experience managing both domestic (US) and international public health research and prevention programs. Experience providing management support and oversight for all stages of project development (proposal, design, implementation, evaluation, and reporting) in a variety of technical areas including cervical cancer prevention, maternal and neonatal health, HIV/AIDS, family planning and reproductive health, and human resource for health. Successful management of a diversely funded portfolio, including USAID, CDC, Bill and Melinda Gates Foundation, and General Electric Foundation funded projects in Ethiopia, Uganda, Peru, Thailand, Philippines and other countries. Participate in and contribute to global technical working groups with key stakeholders such as the World Health Organization (WHO), Alliance for Cervical Cancer Prevention (ACCP), and International Union Against Cancer (UICC), for the development of global guidelines and best practices in cervical cancer prevention.

EXPERIENCE

- 2012 – 2017 **Program Manager, Strengthening Human Resources for Health Project, Jhpiego Corporation (an affiliate of Johns Hopkins University) Addis Ababa, Ethiopia**
- Working closely with the project Chief of Party, managed the implementation of a USAID funded project (\$55Million) focusing on strengthening human resources for health in Ethiopia. Specifically, provided leadership for development of program plans, budgets, and reports, and ensured alignment of program activities with government and stakeholder priorities.
 - Provided direct supervision and management of 4 regional offices, including providing oversight for management systems, supporting and managing regional staff, and ensuring standardization and implementation of best practices across all regional offices.
 - Facilitated compliance with donor rules and regulations, including strengthening systems that supported and monitored compliance processes, as well as mentoring and coaching of staff to help them understand, interpret and implement relevant rules and regulations.
 - Provided oversight for five subawards under the project, including managing contractual processes and partner relationships.
 - Co-principal investigator on a number of research projects designed to generate country-specific evidence related to strengthening pre-service education for human resources for health, as well as motivation and retention of health workers.
 - Served as a member of the project and country office senior management team, providing inputs related to decision-making at the leadership level.
- 2008 – 2012 **Senior Program Officer, Ethiopia and Global Cervical Cancer Prevention Programs Jhpiego Corporation (an affiliate of Johns Hopkins University) Baltimore, Maryland, USA**
- Provided management and programmatic oversight for all Jhpiego cervical cancer prevention programs in Africa, Latin America, and the Caribbean. Specific tasks included donor communications, recruitment of staff and consultants, strategic planning, and budget management.
 - Supervised and provide mentorship to consultants, program coordinators and country technical advisors working on cervical cancer prevention projects.

- Provide head-quarter back-stopping and management support for a large portfolio of projects in Ethiopia including infection prevention and control, prevention of mother-to-child transmission of HIV (PMTCT), Voluntary Testing and Counseling (VCT) and pre-service education. Conducted routine programmatic field visits to plan for program implementation, monitored and evaluated new and ongoing programs, and worked with country team to develop progress reports, work plans, and assessment reports for donors, partners, and stakeholders.

2006 –
2008

Senior Program Coordinator
Jhpiego Corporation (an affiliate of Johns Hopkins University),
Baltimore, Maryland, USA

- Provided support to the program manager to coordinate and support Jhpiego cervical cancer prevention programs in Thailand, Philippines, Indonesia and South Africa. Specific activities included management of donor contractual processes, preparation of donor reports, and coordination of project implementation activities.
- Liaised with field staff to provide programmatic and administrative support for maternal neonatal health and family planning projects in Ghana. Responsible for all data collection and monitoring activities, and provided support to program officer for day-to-day management of activities.
- Contributed to new business development opportunities by participating in proposal writing and editing, identification of potential donors, and developing business development strategies for Uganda and Ghana. Contributions resulted in a three-year, \$900,000 award from the GE Foundation, the first of its kind for Jhpiego.

2003 –
2006

Health Program Analyst
Institute for the Elimination of Health Disparities, University of Medicine and Dentistry
School of Public Health (now Rutgers University)
Newark, New Jersey, USA

- Supported the Executive Director to write grants to secure external funding for research, training and community outreach. Contributions resulted in successful US National Center on Minority Health and Health Disparities (NCMHD) funding for prostate cancer research.
- Developed and maintained a resource center that collected, classified, and stored information on health disparities in the US, with a particular focus on New Jersey.
- Assisted with project management and implementation activities including collecting survey and focus group data, analyzing data and writing reports.
- Developed and prepared organizational publications including fact sheets and project briefs.

2000 –
2003

Research Associate
Unilever Research US (a leading global consumer goods company)
Edgewater, New Jersey, USA

- Tested novel chemical actives developed for clinical trials in different base formulations.
- Monitored physical and chemical stability of formulations.
- Assisted with product application and data collection during clinical trials.
- Received several monetary awards for outstanding contributions to projects.

EDUCATION

- 2015 **Certificate - Strengthening Human Resources for Health (2 week on-site course)**
Harvard University T.H.Chan School of Public Health, Massachusetts, USA
- 2003 **Masters of Public Health (Epidemiology)**
University of Medicine and Dentistry of New Jersey, School of Public Health (now Rutgers University), New Jersey, USA
- 2000 **Bachelors of Science – cum laude (Biology)**
Montclair State University, New Jersey, USA

PUBLICATIONS

Kibwana S, Teshome M, Molla Y, Carr C, Akalu L, van Roosmalen J, Stekelenburg J. *Education, Practice and Competency Gaps of Anesthetists in Ethiopia: Task Analysis*. Journal of Perianesthesia Nursing. May 2017. DOI: doi:10.1016/j.jopan.2017.02.001

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